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Articles

Notes

Inter-country Comparison of Public Enterprise Performance: An Application to the Cement Industry of South Asia

by

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The main objective of the paper is to develop a methodology for evaluating the comparative performance of public sector industries producing the same commodity, but operating in different socio-economic environments. However, a fully satisfactory methodology could not be developed as it had to be adjusted to the contents of available data which were collected prior to the formulation of any such methodology. What the paper, therefore, attempts to do is to indicate the essential ingredients of an appropriate methodology. These are applied on the data on the cement industry in three countries—Bangladesh, India and Sri Lanka—collected in the course of an IDRC Project on public enterprise performance. Value-added per unit of resource use has been used as the main criterion of comparing their performance.

I. INTRODUCTION

The paper has the modest objective of developing an outline of a methodological approach for comparative study of public enterprises which are within a given economic activity area but operating in different national environments. A separate conceptualisation of such a methodological approach is not attempted here but the actual comparative study of public sector cement industries in Bangladesh, India and Sri Lanka, undertaken on the basis of

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the data made available in a number of case studies[1] incorporates the essential elements of the suggested methodological approach. These case studies, however, were completed before a comparative study was even planned. The data in the case studies were, therefore, inadequate to develop and adopt a rigorous comparative study approach. Fresh additional research has not been undertaken to fill these data gaps. The empirical findings in this comparative study are, as a result, far from being conclusive, but the methodological guidelines suggested in this paper, it is hoped, will be of interest and use to those studying public enterprise behaviour.

After a brief discussion of some comparative background material we come to the central problem of the study, namely, the question as to how performance of public enterprises operating in different national environments may be compared. We proceed on the fundamental premise that operational results of public enterprises have to be evaluated and also compared on the basis of what their operational motives are. In the operation and subsequent evaluation of a public enterprise, service to society should take precedence over immediate financial benefits to the enterprise. The first step in an empirical study based on this value premise is the development of quantitative measures to show the extent of service rendered to society by such a public enterprise.

The present study uses the value-added contribution of a public enterprise to national product as the basic statistical indicator of its service to society. In the generation of value-added the enterprise uses the country's productive resources—natural resources, capital and manpower—which are in varying degrees of scarcity. A basic argument subsumed in the paper is that the efficient operation of a public enterprise should be judged by the optimal use of these productive resources in the generation of value-added. An inter-country comparison of value-added generated per unit of economic resources used in production will, it is expected, be a guide to the relative efficiency of resource use in such public enterprises.

A word of caution is required regarding the comparability of the enterprises that are being reviewed. Whereas the data used in the paper cover all public sector production units in cement manufacture in Bangladesh and Sri Lanka, the coverage is limited to only one public sector cement unit out

[1]A multi-country research project on the *Performance of Public Enterprises in Asia*, sponsored by the International Development Research Centre of Canada has generated case studies of a number of public enterprises operating in each of the countries which participated in the project. The present comparative study is an offshoot of this research project and is based essentially on three of the case studies referred to above pertaining to public enterprises in the manufacture of cement in Bangladesh, India and Sri Lanka. Some of the documents which were presented at various progress meetings of the research project and formed the basis of the present study are listed at the end of this paper [1 ; 2 ; 3 ; 4 ; 5 ; 6].

of a total of nine in the case of India. This unit has the capacity to produce one per cent of total Indian cement production and 8.5 per cent of total public sector production of cement in India. The question of how representative this unit is of the Indian public sector cement industry has not been discussed in the Indian case study.

II. BACKGROUND

History of the Enterprises

The beginnings of the cement industry in Bangladesh can be traced to the private entrepreneurial response to the stimuli generated by prevailing market conditions. The location of the factory was determined by proximity to the sources of limestone which is the main raw material. The expansion of the factory from an installed capacity of 60,000 tons per year at the beginning to an installed capacity of 150,000 tons per year in 1958 was also undertaken by private entrepreneurship. The stimulus here too was provided by increasing profit opportunities.

The initiative to manufacture cement in Sri Lanka, on the other hand, was taken by the Sri Lanka government. The availability of a sufficiently large domestic market for the product and cheap sources of good quality raw materials encouraged the initiation of domestic production of cement. Because of the favourable balance of payments position immediately after the war, the country had the resources to meet the foreign exchange component of the initial investments required. The private sector, however, failed to establish cement manufacturing facilities in the country as a result perhaps of lack of sufficient capital and technical know-how, high risk-averseness ; and/or availability of other avenues of investment where returns were quicker and better. The cement factory in Kankesanthurai thus emerged in the public sector as one of the earliest large-scale industrial ventures of Sri Lanka.

The beginnings of cement manufacture within the public sector of India go back only to the early 1970's. Although the public sector cement company managing a number of plants was incorporated in 1965, the actual manufacturing units did not start functioning till the early 1970's. Unlike in Bangladesh or Sri Lanka, the public sector cement units in India were started so as to cater to a very insignificant segment of the local market which was already being serviced by a large number of private firms. The public sector units were set up to increase the existing production capacity but here the government had a clear objective of locating production units in cement deficit areas.

In Bangladesh, the development of the cement industry in the public sector was closely associated with political events. As a consequence of the war with India, the government came to view it undesirable to leave a vital industry

in private hands. The owners of the Chatak Cement Factory were, therefore, made to sell the factory to the East Pakistan Industrial Development Corporation (EPIDC) in 1965.[2]

Production capacity in the public sector cement industry has expanded over the years in all three countries. Although the installed capacity of the plant examined in the Indian study remained unchanged at 200,000 tons per year from 1972 to 1976, the capacity in the entire public sector cement industry in the country appears to have increased. The installed capacity of the Chatak Cement Factory in Bangladesh was 60,000 tons per year at its inception in 1938-41 and since 1965 it has remained at the level of 90,000 tons per year. Public sector cement industry in Bangladesh expanded further as a result of the commissioning of the Chittagong Clinker Grinding Factory in 1974, with an annual installed capacity of 300,000 tons of cement. Over a period of expansion starting from the early 1960's the Ceylon Cement Corporation expanded its installed capacity significantly. Its capacity at present amounts to 270,000 tons of clinker at the plant in Kankesanthurai and 432,000 tons at the one in Puttalam, giving a total of 702,000 tons of clinker (or 719, 550 tons of manufactured cement) for the whole corporation.[3]

The Environment

The underdeveloped state and structure of the economies concerned is perhaps the most important environmental factor common to the public sector enterprises that are being compared here.

Economic underdevelopment in general, and industrial underdevelopment in particular, will have varying influences on the performance of the public sector cement enterprises operating in the three countries. Given the different levels of development attained by the three countries, such influences must naturally operate at varying intensity within the three national environments there by producing a differential impact on performance. Conceptually one can identify the main areas in which such influences are likely to operate most strongly, from the point of view of both the demand for the product and its local supply.

[2] After the liberation of Bangladesh, management of the factory was handed over to Bangladesh Mineral Oil and Gas Corporation (BMOGC). This corporation was bifurcated into Bangladesh Oil & Gas Corporation and Bangladesh Mineral Exploration and Development Corporation (BMEDC) in 1972, and in 1973 the Cement Industry was handed over to BMEDC. Chittagong Clinker Grinding Factory, planned and executed by the EPIDC, went into production in July 1974.

[3] There is another cement plant in Galle but since it is merely a grinding and packing plant using the clinker produced in the other two, it does not add to the total installed clinker producing capacity of the Cement Corporation.

The documents which form the basis of this comparative study make reference to such influences emanating from the underdeveloped economic conditions ; but unfortunately this has not been done systematically and coherently. Shortage of skilled technical personnel, a reflection of the underdeveloped economic conditions, is referred to as a serious problem for the two cement plants in Bangladesh. The marked absence of team spirit among the workers in these plants is attributed, among other things, to the low level of education[4] which is yet another facet of existing underdevelopment. The Sri Lankan study refers to seasonal absenteeism of workers as a problem in one of the cement plants and attributes this to the fact that the workers have the habit of shifting between agricultural pursuits and factory work. The cement industry in all three countries can be expected to be dependent in varying degrees on foreign sources for technology, machinery and equipment and spare parts, although the extent of such dependence cannot be ascertained from the available data.

The general underdevelopment in the economies concerned has implications also for the availability of the necessary infrastructural facilities—power, water, technological support, transport, fire fighting, banking, housing, schooling etc. The availability of these infrastructural facilities is not explicitly examined at all in the Bangladeshi study and only very casually examined in the Indian and Sri Lankan ones. All three Sri Lankan plants are located in places which are, for all intents and purposes, rural in character. The industry, therefore, naturally faces problems arising out of weak infrastructural facilities. Transport difficulties are of particular significance because of the distance between the factories and the limestone quarries on the one hand, and between factories and the principal sectors of domestic product market on the other. Some of these plants had to maintain their own stand-by power generators, water supply schemes, housing schemes etc. The bulkiness of the main raw material, the limestone, made it necessary for the factories to be located in proximity to the quarry sites, in spite of the unavoidable cost disadvantages arising from the poor infrastructural facilities in such areas. The Indian study too refers to problems faced by the cement industry in general due to inadequate infrastructural facilities.

The principal raw materials required for the manufacture of cement are limestone, clay and gypsum. The Indian industry obtains all these raw materials locally. Except for gypsum which is mostly imported, other raw material requirements of the cement corporation in Sri Lanka are locally obtained whereas almost all raw materials used by the Bangladesh industry are imported. Since the Indian and the Sri Lankan plants obtain their limestone requirements

[4] Views may of course, differ as to the degree of significance to be attached to this as a contributory factor for the lack of team spirit among workers.

from their own quarries, they are operating in a highly favourable market for the procurement of their principal raw material input.

Labour market conditions facing these enterprises in the three countries have both favourable and unfavourable effects on cost efficiency. Given the underdeveloped structure of the economies in which unemployment and underemployment is rampant, there obviously is an ample supply of unskilled labour.[5] Under existing conditions, public enterprises are not normally permitted to recruit purely on merit. The political factors coming into play in this regard have been discussed in greater detail in the macro-report of the Bangladesh study than in the other two country reports. This should not, however, be interpreted as a lack of political influence in recruitment of unskilled labour to public enterprises in India or Sri Lanka. Given the politically explosive character of widespread unemployment and underemployment, the governments, depending as they do on popular electoral support, are quite likely to use public enterprises as sources of employment.

In terms of the available supply of personnel in skilled, technical and supervisory grades the public sector enterprises in the three countries operate under quite different conditions. Shortage of skilled and trained personnel is noted as a major problem for the Bangladeshi cement industry. The level of formal training is considered low even among the management personnel here. The Indian study does not go into the subject of the availability of skilled and technical personnel. Given the higher level of industrialisation attained by India relative to the two other countries and also given the fact that the cement industry is one of the most developed industries in that country, it is quite possible that this problem is not at all felt by its public sector cement industry. The Sri Lankan Corporation has made adequate provision for the training of personnel at all levels so as to ensure that the necessary technical and managerial expertise is available to it. However, the Corporation has not been successful in retaining its trained personnel, especially those at higher levels. In these categories the rate of turnover has been found to be very high.

The public sector cement plants in all three countries are operating within controlled product markets, with the nature and extent of control varying from one enterprise to another. During the period under consideration, the public sector unit examined in the Indian study was operating in a seller's market due to scarcity of cement in the country. Prices are determined by the government from time to time and the market for the output of the public sector industry is assured through various controls exercised by the

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[5] Subject to situations like the one already noted for Sri Lanka where workers in the Kankesan Cement Factory have interests in agricultural pursuits while being employed in the factory. In this set up, there can be shortages in unskilled labour too during busy agricultural seasons.

government over cement distribution and sale. In Sri Lanka the only domestic producer of cement is the public corporation under study. Since imports of cement were regulated according to whether and by how much domestic production fell short of domestic needs, the Corporation operated in a virtually monopolistic product market. Various controls were, however, exercised by the government over product pricing to prevent the Corporation from charging a monopoly price for its output. Since the Corporation was unable to produce enough to meet the full market requirements at the low prices as controlled by the government, artificial shortages emerged in the market with attendant problems which are quite common in such controlled market situations. Product market conditions in Bangladesh were also quite similar to those of Sri Lanka. Because of foreign exchange difficulties import of cement was restricted and the public sector cement factories—the only cement production units in the country—were able to operate in monopolistic market conditions. In this situation, government introduced various controls over public sector cement industry with respect to price fixation, product distribution and input procurement, in order to safeguard the public interest against any possible use of its full monopoly powers.

Government controls and regulatory systems have produced varying types and degrees of influences over different activity areas of the enterprises concerned : production, finance, marketing, personnel etc. A detailed systematic comparison of the influence of these different types or government controls over enterprise activities is not undertaken here because of the limitations of space and data. It is quite clear that although public sector cement production in all three countries is in the hands of semi-autonomous public corporations, the degree of autonomy granted to them is negligible. During the period under review, government controls operated at almost all significant points in the operation of these enterprises.

Internal Enterprise Conditions

The public sector cement plants in all three countries concerned are using techniques and technologies developed in advanced countries. Given the fact that the level of industrialisation in general and the level of development in the cement industry in particular are higher in India than in the two other countries, the degree of dependence of the Indian plant on foreign technology is likely to be less than that of the plants in Bangladesh and Sri Lanka. There is, however, no means of quantifying their relative degrees of foreign technological dependence.

Details of the sources and the manner of procurement of the technology and the necessary capital equipment are not given in the Indian study. The plant and machinery at all three manufacturing units in Sri Lanka are imported, the major suppliers being German and Danish. In Bangladesh too, the machinery suppliers were either from Germany or from Denmark.

In the production of cement, Sri Lankan and Bangladeshi factories use what is known as the dry process as against the wet process adopted in the case of the Indian plant. This difference in the production process has implications for fuel consumption patterns, with the Indian plant having to use more fuel per ton of cement produced as compared to the factories in Bangladesh and Sri Lanka.

As has been noted earlier, the public sector cement industry in all three countries produces for an essentially seller's market. Little selling effort is needed. As noted in the Sri Lankan study, whatever advertising is undertaken by the Cement Corporation is basically for the maintenance of its commercial image. In all three countries, the marketing division is not permitted to carry out many functions which are normally the province of an enterprise's marketing division. The marketing divisions of these factories have thus become "mere record-keeping offices". In all three countries, the scale of priorities in the distribution of cement and the channels through which such distribution was effected were determined broadly by the government. The governmental requirements were generally given priority treatment in the determination of the pattern of cement distribution. The overall distribution pattern was thus largely beyond the control of the enterprises concerned. The government exercised control over pricing of the product in all three countries in addition to the determination of the broad patterns and channels of product distribution. Given the sellers' market conditions obtaining in all three countries such government controls were considered unavoidable to safeguard the public interest. Whatever their justification, these controls have restricted the role of the marketing divisions of the enterprises under study.

Similarly, various controls exercised by outside bodies have restricted the role of other functional divisions. As explicitly argued in the Bangladeshi study, the major financial decisions pertaining to the enterprises were taken not by the corporation in charge of these factories but by the government. This made the enterprise's finance division a mere book-keeping office.

The governmental influence in financial matters was similarly over-powering in the case of the enterprises in India and Sri Lanka too. Financial planning by all three national enterprises is based on annual budgets. But, these are seldom used as tools of control and planning.

In all three countries, in all major aspects of personnel management like recruitment, promotion, remuneration, discipline etc., external influences were generally high. The activities in this area that were left to the discretion of the internal management were quite limited. Comprehensive criteria for the selection and recruitment of employees do not seem to have existed in these public enterprises ; neither was there any system of long-term planning in worker-recruitment.

In both Bangladesh and Sri Lanka, the remuneration practices were governed by government regulations. The objective on which the government acted here seems to have been to ensure uniformity in salary scales in the public corporation sector rather than to elicit the optimum productive performance from employees. In addition to salaries/wages paid, the enterprises in these countries were also implementing production incentive schemes.

III. COMPARATIVE EVALUATION OF PERFORMANCE

Enterprise Objectives

The behaviour of a public enterprise will largely be dictated by the particular place it has in the society's value system and the structure of overall motives of public policy. Any attempt at performance evaluation of such an enterprise must, therefore, be related to its operational objectives. No public enterprise in whatever country and in whatever economic area it operates, will have total freedom to formulate its goals and objectives. In addition to its internal management, the executive and legislative authorities of the country, members of the general public, enterprise employees and their trade unions and the national press may exercise varying degrees of influence in the formulation of these objectives. Some of the objectives so formulated are purely internal to the enterprise, while the others are internalised national goals.

The public sector cement industries in all three countries concerned have been operating on a set of vaguely stated objectives without a clearly laid down scale of priorities and a system of trade-offs between them. From an internal management point of view, their objectives centred on three interrelated aspects : volume of production, cost of production and profits. In Bangladesh the enterprise management is said to view themselves as production maximisers. In addition, they are said to be interested in minimising costs and maximising profits. To increase production capacity in the country's cement industry and in particular to convert cement deficit areas into surplus ones was a primary objective of the establishment of cement producing units in the public sector in India. Increase in domestic production for self-sufficiency in cement has been the prime objective of the Cement Corporation in Sri Lanka. While trying to minimise costs and also to maintain low and stable prices, the Corporation intends to make reasonable profits. A reasonable rate of return on investment appears as one of the main internal management objectives. Further, some contribution to government revenue was expected from the enterprise and this could only be achieved by pursuing the profit objective.

Certain national objectives also came to be internalised in the management of public enterprises. In Bangladesh and Sri Lanka which were subject to severe balance of payments difficulties, the national objective of foreign exchange saving is internalised within their public sector cement enterprises. These

two countries, moreover, have a widespread problem of unemployment and underemployment and, therefore, it is no wonder that public enterprises manufacturing cement in these countries are expected to contribute their share to the government's attempt at finding jobs for a growing labour force. Any enterprise whether it is in the public or the private sector, creates jobs and also may save foreign exchange in the course of its normal operations. But to internalise foreign exchange and employment objectives in the functioning of a public enterprise implies that the government expects it to work towards the achievement of such objectives directly, consciously and deliberately.

Unless the purely internal objectives are carefully defined to accommodate such internalised national objectives, the emergence of some degree of inconsistency between these different objectives is unavoidable. This is particularly so in the relationship between the enterprise's commercial objectives on the one hand, and the internalised national objectives of employment creation and regional development on the other. The relevant trade-offs are generally left undetermined and unquantified. The public enterprise incurs costs (in terms of its financial performance) as a result of its having to pursue similar national objectives. The government does not, however, explicitly commit itself to meet these costs by way of subsidies. Since, given its public character, the enterprise is not in a position to pursue commercial objectives alone by ignoring national problems and government priorities, it is not fair, from the point of view of the management, to evaluate performance of a public enterprise purely on normal commercial criteria. Neither is it correct to do so.

Value-added and Production

If the performance of a public enterprise were to be judged in terms of its contribution to the national economy and social well-being then a statistical measure of this contribution is necessary in any evaluatory study of public enterprises. Value-added by such an enterprise is considered here as a reasonable, *albeit* approximate, indicator of its contribution to national economy and social well-being. Value-added data pertaining to public enterprises in cement production in the three countries under consideration are presented in Table I. The data pertaining to the Indian firm are indicative merely of orders of magnitude.

Even if such data weaknesses are disregarded the estimates in Table I are obviously not directly comparable across countries. On the one hand, they are in terms of the three national currencies and on the other hand, the data for Bangladesh and Sri Lanka cover their public sector cement industry in toto whereas the Indian data pertain to just one plant in the public sector cement industry in that country.

Although the data in Table I are not comparable across countries, they can be used to compare the progress achieved over time by the public sector cement industry in the three countries. This, however, requires value-added

TABLE I

VALUE-ADDED (CURRENT PRICES) BY PUBLIC ENTERPRISES IN CEMENT PRODUCTION

Year[a]	Bangladesh[b] (Taka '000)	India[c] (Rs. '000)	Sri Lanka[d] (Rs. '000)
1970 (or 1969/70)	989	—	n.a.
1971 (or 1970/71)	n.a.	—	42,998[e]
1972 (or 1971/72)	n.a.	—	42,460
1973 (or 1972/73)	2,697	4,510	48,234
1974 (or 1973/74)	18,750	5,826	70,553
1975 (or 1974/75)	58,403	7,623	51,200
1976 (or 1975/76)	53,117	n.a.	48,995

Source : PPEA Study Documents (See references at the end of the article) and private correspondence.

Notes : [a]Calendar years for Sri Lanka ; financial years within brackets for Bangladesh and India.

[b]Value-added by only the Chatak Cement Factory upto 1973/74 (inclusive) and its value-added plus that of the Chittagong Clinker Grinding Factory since then.

[c]Approximate figures for only one public sector plant. Worked out on the basis of the per cent breakdown of the cost of production as provided in the relevant source.

[d]Value-added by all three plants under the management of the Ceylon Cement Corporation.

[e]Since calendar year has been accepted as the Corporation's financial year from 1971, this figure corresponds to value-added by the Corporation in the last nine months of 1971 plus *pro rata* three months' value-added generated in the financial year of 1970/71.

n. a. = not available
— = plant not in operation.

data in constant price terms. Constant price estimates of value-added have been obtained for this purpose by deflating the relevant current price estimates using indices of cement prices in the three countries.[6]

The temporal performance of the public sector cement industry in the three countries can now be compared using the annual growth rates implied in these constant price estimates of value-added (Table II). In order to complement the data on value-added growth, data on the growth of physical production are presented in Table III.

[6]A completely accurate deflation procedure, however, requires that the sales revenue is deflated by cement prices and intermediate payments by price indices appropriate for such payments.

TABLE II

ANNUAL PER CENT GROWTH OF VALUE-ADDED BY PUBLIC SECTOR CEMENT ENTERPRISES AT CONSTANT PRICES

Period	Annual Growth of Value-Added ; Per cent		
	Bangladesh	India	Sri Lanka
1973 (1972/73) 1974 (1973/74)	+146	+6	+21
1974 (1973/74) 1975 (1974/75)	+98	+18	−41
1975 (1974/75) 1976 (1975/76)	−28	n.a.	−4

Source : Same as for Table I.

TABLE III

ANNUAL PER CENT GROWTH OF PRODUCTION IN PUBLIC SECTOR CEMENT INDUSTRY

Period	Annual Growth of Value-Added ; Per cent		
	Bangladesh	India	Sir Lanka
1973 (1972/73) 1974 (1973/74)	+67	n.a.	+12
1974 (1973/74) 1975 (1974/75)	+173	+5	−17
1975 (1974/75) 1976 (1975/76)	+11	+38	+8

Source : Study Documents, *Op.cit.*

Whereas there was slow but consistent growth in the Indian plant under consideration the Sri Lankan enterprise registered negligibly slow growth, if not an actual decline. The growth of the Bangladeshi enterprise, on the other hand, though a little erratic, was clearly more rapid. Its growth over the two-year period 1972/73-1974/75 in particular was appreciably high. The growth rates in Tables II and III, however, need to be interpreted with care. On the one hand, the period taken for analysis is too short for an inter-enterprise comparison of growth performance. Of particular significance is the fact that these years constituted the very initial stage in the operation of the Indian plant. In the case of the Bangladeshi industry this was the period

immediately after the disruptions created by the liberation war. On the other hand, the installed capacity of the Bangladeshi industry increased heavily as a result of the commissioning of the Chittagong Clinker Grinding Factory (CCGF) in 1973/74 whereas installed capacity in both India and Sri Lanka remained unchanged during this period. It is to be noted, moreover that the drop in value-added in the Bangladeshi industry in 1974/75-1975/76 was more or less entirely due to the drop in value-added in the older plant, the Chatak Cement Factory (CCF). While physical production of the older factory dropped during this period, that of the new factory, the CCGF increased.

Thus there is a certain degree of non-comparability in the data pertaining to the enterprises in the three national environments. But the difference in the rates of growth of both value-added and physical production as between the Bangladeshi industry on the one hand, and the Indian and Sri Lankan industries on the other, is too large to be explained purely by such non-comparability. In terms of output growth in the early seventies, the public sector cement industry in Bangladesh showed much better performance than its counterparts in India and Sri Lanka. In the absence of data extending over a longer period, it is not possible to determine whether such high growth performance was typical of the Bangladeshi cement industry in the recent past. According to available data themselves, some tapering off seems to have taken place in its growth after 1974/75.

Resource Use Conditions

The productive activity of an enterprise, whether public or private, involves the use of resources which are available in varying degrees of relative scarcity.

Of the three broad categories of resources that go into any productive activity—labour, capital and natural resources—capital is relatively more scarce than labour in the three countries under consideration. The main natural resource utilised in the cement industry—limestone and clay—is also in short supply. In fact, the clinker producing factory at Chatak in Bangladesh[7] uses a limestone quarry within Indian borders.

The degree of efficiency at which resources were actually used by the cement plants under study can be determined individually for each plant, if a series of resource-use-optimality norms are computed. Such a computation has not been made in the work which forms the basis of this comparative study. In the absence of such appropriate optimality norms the value-added generated per unit of resources used in the cement industry in different countries is compared hoping that this will provide some measure of the relative efficiency in resource use.

(*a*) *Capital :* The cement industry uses a relatively capital-intensive production technology. Given the scarcity of capital in all three countries under

[7]The other plant in Bangladesh is merely a clinker grinding factory and the clinker for its operations is obtained also from abroad.

consideration, the efficient use of capital is of great national significance. Value-added per currency unit of capital employed in the public sector cement industry in the three countries is presented in Table IV for three years for which data are available. Value-added generated in the Bangladeshi industry in 1972/73 and 1973/74 was more than three times the capital employed. With the commissioning of the CCGF in 1974/75 the ratio went down to 0.75 but even at this lower level the Bangladeshi ratio was more than four times that of the two other countries.

The differences across the countries in the ratio of value-added to capital employed has several implications. Some of the implications of such differences may be mentioned here. Firstly, the relative position of an industry in terms of this ratio may indicate the patterns of relationship that exist in these different enterprises between product prices on the one hand and costs of production and sale on the other. Secondly, it may indicate differences in the assets structure of the industries that are being compared.[8] Thirdly, it implies that capital employed in the enterprises concerned is utilised at different degrees of efficiency.[9]

TABLE IV

RATIO OF VALUE-ADDED TO CAPITAL EMPLOYED[a]
(AT CURRENT PRICES)

Country	1973 or 1972/73	1974 or 1973/74	1975 or 1974/75
Bangladesh	3.80	3.55	0.75
India	0.08	0.10	0.14
Sri Lanka	0.15	0.21	0.15

Source : Study Documents, *Op. cit.*

Note : [a]Fixed assets plus current assets minus current liabilities is taken as capital employed. For India, capital employed data are not separately available. Capital employed in the Indian industry is, therefore, estimated using the available data on (i) the ratios of net sales to total capital employed and (ii) net sales.

If the third implication of differential ratios of value-added to capital employed is to be brought into light, the variation in Table IV ratios arising

[8]Since capital employed is defined as fixed assets + current assets — current liabilities (or fixed assets + net current assets), the larger the current liabilities (or the smaller the net current assets), other things being equal, the higher will be the ratio of value-added to capital employed.

[9]These are only some of the inferences which can be drawn from inter-country variations in the ratio of value-added to capital employed in a given industry. As argued later, differences in this ratio can be attributed to other factors too.

out of (a) differential cost—price relationships (b) differences in the assets structure and (c) other differences has to be eliminated.

It is clear that the greater the excess of the product price over the unit cost of production and sale, the larger will be the ratio of value-added to capital employed, other things being equal. Examination of data for the three countries under consideration shows that there has been significant variation in the product price net of the cost of production and sale. If the ratios in Table IV are weighted by the ratios of unit cost to sales price, one type of bias in the former ratios could be eliminated to a large extent. Corrected ratios of value-added to capital employed are presented in Table V.

TABLE V

RATIOS OF VALUE-ADDED TO CAPITAL EMPLOYED CORRECTED FOR DIFFERENTIAL COST-PRICE RATIO

Year/Country	1973 or 1972/73	1974 or 1973/74	1975 or 1974/75
Bangladesh	4.18	1.95	0.46
India	0.10	0.12	0.15
Sri Lanka	0.13	0.17	0.15

Source : Study Documents, *Op. cit.*

The picture which emerged from Table IV in favour of the Bangladeshi industry is modified to a large extent in Table V, except in the case of the financial year 1972/73. Since the Bangladeshi enterprise incurred losses in this year, the corrected ratio of value-added to capital is even higher than the uncorrected one.

The corrected ratios in Table V are indicative of the degree of efficiency at which capital is utilised and also of differences in the asset structure and other factors affecting the enterprises concerned. The Bangladeshi ratio for 1972/73 is very high because current liabilities of the CCF in that year dominated the composition of the capital employed. Current liabilities in that year amounted to more than 17 times the capital employed. Fixed and current assets together of the CCF in 1972/73 were merely six per cent higher than current liabilities ; current liabilities amounted to about 3 times fixed assets.

Even the ratios in Table V are not strictly comparable because of the variation of the composition of capital employed from one country to another. To eliminate from these ratios the implication of a differential assets structure we have weighted them with the ratio of capital employed to fixed assets. Capital employed/fixed assets ratio has been used for this purpose because

in an examination of the degree of efficiency at which an enterprise utilises its capital, efficiency of utilisation of fixed assets is of crucial significance, particularly if the capital-intensity of the enterprise concerned is high. The ratios thus corrected are given in Table VI.

TABLE VI

CORRECTED VALUE-ADDED / CAPITAL EMPLOYED RATIOS

Year	1973 or 1972/73	1974 or 1973/74	1975 or 1974/75
Bangladesh	0.71	1.76	0.68
India	0.11	0.14	0.16
Sri Lanka	0.16	0.23	0.23

Source : Study Documents, *Op. cit.*

These ratios seem to show that in terms of value-added generated, a unit of capital employed in the public sector cement industry in Bangladesh was substantially more productive than in India or Sri Lanka, even when some correction is made for inter-country differences in (a) product price—production cost relationships and (b) the relative significance of current liabilities in capital employed.[10]

The statistical evidence marshalled so far, however, does not seem to be adequate to support a very strong conclusion on the above lines. In spite of the corrections made, ratios in Table VI do not seem to be sufficiently comparable to warrant strong inferences about inter-country differences in the efficiency of the use of capital in the public sector cement industry. At least two more factors can be mentioned as affecting comparability.

Firstly, the composition of fixed assets owned by the enterprises in different national environments, particularly the proportion of directly productive fixed assets in the total, is likely to vary from one country to another.[11] In the absence of relevant data, it is not possible to assess the influence of this particular factor on the subject under discussion.

Secondly, the age of the plant and machinery affects the value of net fixed assets and, therefore, the amount of capital employed. This factor is to some extent reflected in the ratio of unit cost of production to sales price.

[10]It is by no means implied here that the very simple weighting method adopted here has completely eliminated the varying influences of these two factors (a) and (b) on value-added productivity of the capital employed in the industries concerned.

[11]The relative significance of non-directly-productive fixed assets like residential quarters for staff may vary from one enterprise to another. This will obviously have some influence on relative "value-added productivity" of capital in the industry in different environments.

But the method adopted above for weighting the ratios of value-added to capital employed does not seem to have completely eliminated the variable influence of the age of the plant.

Comparability is also impaired by other indicators which discount the favourable position that the Bangladeshi industry occupies in a comparison based on Table VI. One such indicator is the per cent utilisation of installed capacity in the industry in the three countries (Table VII). In terms of this indicator, Bangladesh does not seem to have used its capital assets significantly better than the other two countries except for the year 1974/75 (see Table VII). Thus the divergences in the country environments seem to be too

TABLE VII

PER CENT UTILISATION OF INSTALLED CAPACITY

Year	1973 or 1972/73	1974 or 1973/74	1975 or 1974/75
Bangladesh			
CCF	34.9	58.3	102.9
CCGF	—	—	16.8
India	34.5	55.1	57.8
Sri Lanka	59.1	62.4	53.7

Source : Study Documents, *Op. cit.*

strong to permit a straightforward inter-country comparison between units of even a given industry. A simple correction for the more obvious differences do not seem to fully resolve this intricate problem.

(*b*) *Materials :* Some of the main intermediate inputs used in cement manufacture, limestone and clay for example, are valuable types of exhaustible natural resources that a country may have. While the cement industries in Sri Lanka and India obtain these materials from their own property, the Bangladesh industry obtains its limestone supply from India. The clinker for CCGF in Bangladesh is also procured from abroad. Some other significant materials like fuel is imported for the use of the cement industry in all three countries where foreign exchange is a valuable national resource. Comparison of performance of these enterprises, therefore, requires an examination of the efficiency of use of all these resource inputs. In the absence of physical data this could only be done using monetary values. All the familiar questions arising out of price structure differences arise here too and complicate the analysis.

The question of how the domestic natural resources are valued is a particularly tricky issue in this connection.[12]

Cost[13] of producing a ton of cement in India, Bangladesh and Sri Lanka in 1974/75 (or 1975) was, in terms of Indian Rupees, 195.19, 287.84 and 279.44 respectively. The proportions of intermediate inputs in unit cost of production in the latest year under consideration are given in Table VIII.

TABLE VIII

PROPORTION OF EXPENDITURE ON INTERMEDIATE INPUTS IN UNIT COST OF PRODUCTION OF CEMENT IN 1975 (OR 1974/75)

Items	Per cent of Unit Cost of Production		
	Bangladesh	India	Sri Lanka
Raw Materials	49	13	
Fuel, Power &			63
Consumables	24	36	

Source : Study Documents, *Op. cit.*

It can be seen that although the proportion of the cost of raw materials, fuel, power and consumables in unit cost of production was less than 50 per cent in India in 1974/75, it was 63 per cent in Sri Lanka and as high as 73 per cent in Bangladesh. But because of significant inter-country differences in other related variables, the percentages in Table VIII cannot be taken as a straight forward indicator of a greater degree of material usage efficiency in the Indian industry. As already noted, the Bangladesh industry pays international prices for almost all of its raw material inputs but its Indian and Sri Lankan counterparts are likely to value the limestone it obtains from their own quarries at much less than world prices. As between the Indian and Sri Lankan plants in turn, the valuation of these domestic material

[12]The value of limestone used in the Sri Lankan industry (and also perhaps the Indian one) is taken to equal the sum of (a) the hypothetical valuation of the natural resource involved, (b) the cost of labour, materials and machinery depreciation involved in quarrying and (c) cost of transport from quarries to factory site. The relevant breakdown is not available. It is possible in these circumstances for value-added figures which provided the basis of the analysis so far to be subject to some understatement in the case of the Sri Lankan (and also perhaps the Indian) industry because the value of limestone used, as measured above, is treated as an intermediate input and deducted from sales revenue to derive value-added, without crediting the enterprise for the value-added created in limestone quarrying from its own property and transporting it to factory site. Since limestone and clinker are imported for the CCF and CCGF respectively in Bangladesh, this question does not arise in the case of that country.

[13]At 1975 exchange rates. According to these rates US \$1=Taka 14.826=Indian Rs. 8.937=S.L.Rs. (with FEECS) 12.726.

inputs is likely to be based on different principles. The age of the CCF in Bangladesh is responsible for reducing the size of the depreciation component of its unit cost of production (or alternatively raising its raw material component). Moreover, power must be available for these industries at mutually non-comparable rates in the three different countries. Thus the differences in the percentages in Table VIII are not unequivocal indices of the relative degrees of efficiency at which intermediate inputs are used by public sector cement industry in these countries.

(*c*) *Labour :* Relative to total labour force or to that part of it engaged in manufacturing industry in each respective country, the total number of employees in the enterprises under consideration is very small. In 1975, there were 692 employees in CCF and 253 in CCGF in Bangladesh, 568 in the Indian plant and 2,528 in all three plants of the Sri Lankan Corporation. The installed capacity of these plants per employee on the basis of the above numbers was 130 tons for CCF and 1,186 for CCGF in Bangladesh, 352 tons for India and 285 tons for Sri Lanka. A full interpretation of these figures of installed capacity per employee obviously requires details of the technological conditions but even without such details one is tempted to infer that the CCF in Bangladesh was the most lax in its manning policies. The CCF in Bangladesh had a total installed capacity of 150,000 tons from 1958 to 1965 but after 1965, when its older kiln went out of production, its installed capacity dropped to 90,000 tons. It is quite possible that because of difficulties in laying-off workers in a public enterprise, the CCF had to carry a heavy burden of redundant labour after 1965. Underutilisation of labour is noted also as a problem in the Sri Lankan enterprise.

Contribution of an employee, on average, to value-added and physical production is compared across the three countries in Table IX. Physical production per employee, sometimes considered as an index of labour productivity has been the highest for India, and the lowest for the CCF in Bangladesh. Relative to the Indian enterprise, production per employee was also quite low in the Sri Lankan corporation. Although installed capacity per employee was the highest in the CCGF of Bangladesh, actual production per employee there was lower than in India. Different inferences one can draw from installed capacity per employee on the one hand, and actual production per employee on the other, are due to differences in the rates of utilisation of installed capacity.

Inferences that could be drawn from comparative data on value-added per employee are quite limited. Value-added per employee was the highest in Bangladesh (disregarding 1972/73). But it has already been mentioned that product prices relative to production costs were higher in Bangladesh than in the two other countries. In addition, there are the widely known pitfalls in official-exchange-rate-based monetary conversions for purposes of international comparison.

TABLE IX

VALUE-ADDED PER EMPLOYEE AND PRODUCTION PER EMPLOYEE

	Bangladesh				India		Sri Lanka	
	V-A per Employee Indian Rs. (a)		Production per Employee Tons		V-A per Employee Indian Rs. (a)	Production per Employee Tons	V-A per Employee Indian Rs. (a)	Production per Employee Tons
	CCF	CCGF	CCF	CCGF				
1973 or 1972/73	4,667	—	54	—	11,191	171	12,996	152
1974 or 1973/74	29,715	—	83	—	12,343	233	20,309	183
1975 or 1974/75	36,121	40,399	134	199	13,516	206	14,218	153

Source : Study Documents, *Op. cit.*

Note : (a) At exchange rates prevailing in these years. Sri Lanka Rupee rate used for conversion includes the FEEC premium.

Efficiency in resource use requires that production be undertaken with optimum use of available resource inputs. Although the scarcity of natural resources and capital is acutely felt in all three countries under consideration and, therefore, some attempt will be made to economise in their use, public enterprises might tend to be rather lax in their policies concerning the use of unskilled labour. Given the acute problem of unemployment and under-employment labour is likely to be considered, at least for the time being, an abundant resource. There are also the political pressures to over-man the public enterprises arising out of government commitment to employment generation as a national objective.

Although labour productivity in the CCF of Bangladesh was lower than in the Indian and the Sri Lankan industries, there was a clear improvement in its labour productivity over the three year period for which data are available. No such clear movement was visible in the two other countries. As far as the Bangladeshi industry is concerned, this improvement in labour productivity corroborates the available evidence regarding output growth.

Financial Profitability

The analysis so far has been in terms of the value-added contribution of the enterprises concerned to national product. This particular analytical approach was selected on the premise that an enterprise's value-added is an approximation to its contribution to social welfare. Part of an

enterprise's value-added is made up of its net profit before tax. In the case of a private enterprise only the part of its net profit appropriated by the government is available for expenditure on general social welfare. But in the case of a public enterprise the entirety of the net profit before tax is available for use to promote general social advancement.

Profitability is undoubtedly the central measure of performance in a private enterprise. Although it may be relegated to a secondary position in public enterprise management and evaluation, profitability is nevertheless necessary for viability of public enterprises too. There are two main reasons for governmental concern with the profitability of a public enterprise : (a) to eliminate its dependence on governmental funds and to, in fact, make it a source of net revenue for the government and (b) to be able to use profitability as a means of stimulating managerial and technological efficiency. It is fairly obvious that a public enterprise should not try to maximise financial profits but reasonable, adequate profits on suitable national norms would undoubtedly be expected from its operations.

The Indian firm and the CCGF of Bangladesh made losses during the period under consideration. These losses probably reflected infant stage problems. The Indian plant was commissioned in 1972 and the CCGF in 1973. The latter's loss which amounted to Taka 2,047 thousand[14] in 1973/74 has increased to Taka 6,695.7 thousand in 1974/75. The loss incurred by the Indian plant, on the other hand, declined from Rs. 3,960 thousand in 1973/74 to Rs. 1,967 thousand in 1974/75. The Sri Lankan corporation earned a profit of Rs. 11,683 thousand in 1972/73, Rs. 32,607 thousand in 1973/74 and Rs. 12,034 thousand in 1974/75. The Chatak Cement Factory, the older one of the two in Bangladesh, incurred a loss of Taka 427 thousand in 1972/73 but improved its commercial performance dramatically in the following year to earn a profit of Taka 13,767 thousand. Its profit in 1974/75 increased still further to reach Taka 17,178 thousand. The rate of return calculated as the ratio of net profit to capital investment for the whole public sector cement industry in Bangladesh amounted to 10.2 per cent in 1974/75 but for the Sri Lankan industry it was as low as 3.2 per cent in 1975. In 1974, however, the Sri Lankan Corporation also showed a rate of return of 9.2 per cent.

Rate of return, however, is too aggregate a figure to serve as a meaningful indicator of efficient operation in the case of a public enterprise. It is a still weaker indicator in a comparative assessment of a number of such enterprises in different national environments. The rate of return is the end result of the

[14]This figure is for a part of the financial year as the CCGF started its operations in 1974.

operation of a plethora of diverse factors. It is in itself unable to reveal these factors and they are of equal significance in a comparative assessment of such a series of enterprises. Profits are no doubt necessary for a public enterprise, for survival, growth and self-reliance, but profits so made should be just adequate to meet these objectives. Making profits in excess of what is required for these purposes will be in conflict with other objectives of operating the enterprise within the public sector.

A public enterprise which is expected to be service-oriented has to be concerned with the degree of satisfaction it provides to its customers by maintaining satisfactory product quality and reasonably low product prices. A public enterprise operating in a monopolistic product market, as the public sector cement industries in Bangladesh and Sri Lanka do, will be able to disregard these obligations to its customers and still make very high profits.

There is no mention of product quality in the Indian study. Except for mentioning that the quality of cement produced depends on the quality of the raw materials and that CCF's cement enjoys a better reputation in the market for its quality, the Bangladesh study also does not provide any details of quality tests and their results. The Sri Lankan study, on the other hand, provides results of quality tests and shows that the Portland Cement produced by the Corporation is in accordance with the British Standard Specification.

The question of prices in relation to cost of production has already been considered. Since the enterprises are public, the price of their product is under public control in all three countries. The Indian plant contributed a small proportion to total production of cement in the country. The price of cement in India, determined not merely on the basis of the cost conditions in the plant under consideration, happened to be lower than the plant's unit cost in its first three years of operation. The unit cost of production in 1974/75 in the case of this plant was 103 per cent of the price of cement determined by the government.

The Sri Lankan study examines in detail, the procedures adopted in price-fixing and various controls exercised by the government to maintain fair prices. As a result of these checks and controls, price of cement has been maintained only slightly above cost of production. A fair proportion of these actual costs, however, may have been avoidable. It must nevertheless be stressed here that as a result of the government's refusal to give a free hand to the Corporation in fixing prices of its product, the consumers were protected to some extent against the Corporation's monopolistic position in the product market.

IV. CONCLUDING REMARKS

In the foregoing sections, the performance of three public enterprises operating in three different environments was examined and compared from three different but related view points :

(a) contribution to national economy in terms of value-added ;
(b) efficiency in resource use ; and
(c) commercial profitability.

Because of data constraints, some areas of the analysis are left incomplete but the methodological suggestions presented in the course of this empirical analysis, it is hoped, are valid and useful for public enterprise study.

The main empirical conclusion of the study is that, from the majority of points, the Bangladeshi enterprise, particularly its CCF, stands out at a clearly higher level of performance than those in India and Sri Lanka. This is interesting because the Bangladeshi enterprise was seen earlier to be in a relatively more disadvantageous position in terms of a number of aspects of its environment and internal enterprise conditions. Available data are insufficient to clearly and conclusively identify the factors which led to its better performance.

The question of an unequivocal overall grading of the three enterprises in terms of performance has not been raised. In the type of analysis which is made feasible by the extent and the quality of available data, such a system of grading must be done, if at all, in terms of different "areas of performance" separately. Given the diversity of their respective environments, one must question the utility and the meaningfulness of even such a system of grading. In so far as the relevant trade-offs between conflicting objectives are left unspecified and unquantified, the above situation is unavoidable.

REFERENCES

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Rural Development and Family Planning Behaviour in Bangladesh Villages*

by

MOHAMMAD ALAUDDIN**

The purpose of the study is to examine the variation in knowledge and usage of contraceptive methods across Bangladesh villages. The main hypothesis is that the variation can be explained by three sets of factors measured at the village-level : development programmes, family planning programme efforts, and given environmental and socio-economic conditions. Data are drawn from the Bangladesh Fertility Survey and the 1974 Bangladesh Population Census. The three sets of factors taken together explain a greater proportion of the variance in knowledge and usage of contraceptive methods than each of the sets taken singly or in paired combination. Knowledge of clinical contraceptive methods is found to be affected more by development programmes than by either family planning or environmental and socio-economic conditions. Knowledge of non-clinical contraceptive methods, on the other hand, is affected more by given environmental and socio-economic conditions. While both development and family planning variables have independent and approximately equal effects on ever use of contraception, each of them separately is not likely to produce as much contraceptive usage as would both of them jointly. The policy implication of this finding is that if both development and family planning programmes are provided to the villages, the impact on fertility may be maximized.

I. INTRODUCTION

Based on the hypothesis that the demographic and development goals of the less developed countries of the world might be more effectively achieved by conjoint efforts in both population control and development programmes rather than in population control alone, Bangladesh is seeking simultaneously both social development and reduction of fertility in its rural areas.

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A comprehensive organization with the involvement of several ministries (Health and Population Control, Agriculture, Education, Rural Development, Labour and Social Welfare, and Information and Broadcasting) and a cross-disciplinary approach is being built and programmes organized at the grass-roots village level [6, p.11]. In redefining its national population policy, the government makes it explicit and stresses the urgent need for total reorientation of the strategy, making "population control and family planning programmes an integral part of social mobilization and national development efforts" [5, p. 2].

The new strategy reflects the international community's awareness of the impact of population trends on socio-economic development and recognizes the world-wide shift in orientation that was in evidence at the 1974 Bucharest Conference, which concluded :

> Population and development are interrelated : population variables influence development variables and are also influenced by them [11, p. 11].

Limited empirical evidence drawn from cross-national studies support such a hypothesis. But unfortunately, the findings do not relate to current and foreseeable rural development programmes at the grass-roots village level and nor do they provide practical guidelines as to which development policies need to be reinforced in order to realize population goals within the context of broader rural development schemes.

II. THE RESEARCH QUESTIONS AND THE MODEL

Broadly stated, this research addresses the question of the relative contributions of various development programmes and family planning programme efforts to the variation in fertility phenomena at the grass-roots village level in Bangladesh. The specific questions we are investigating are :

1. Do the development programmes have any independent contribution to the village level knowledge and usage of contaceptive methods?
2. If they do, what is their relative strength compared to family planning programmes?
3. What are the joint and separate effects of development and family planning programmes on the village-level knowledge and use of contraception?

While investigating these questions, we are not interested in individual variation in reproductive behaviour but in the variation of such behaviour

across villages. The focus will be on accounting for the variation across villages in relation to the environmental and socio-economic conditions of the villages and the development and family planning programmes available to them.

Aggregate fertility related measures are taken as dependent variables and their variation is analysed with respect to three sets of independent variables, namely, development programmes, family planning programmes and given socio-economic conditions.

The practical implication of the research is that it could provide insight into the questions, on the one hand, of the relative importance of village-level, general development and family planning programme activities in facilitating contraceptive acceptance among the rural couples and, on the other hand, of the advisability of integrating population control activities with those elements of development programmes which seem to facilitate contraceptive acceptance.

Definition of Key Concepts

Village : A village,[1] in Bangladesh, is a distinct geographical area ; it is the primary unit of civil and revenue administration. It is also the primary reporting unit in the population census. The village represents a relatively homogeneous population and has served in recent years as an areal base for the purpose of socio-economic development. For the purposes of BFS, a village was operationally defined as having a physical boundary with a distinct name in use by revenue, civil, and census administration. The villages defined in these ways usually contain 50 or more households. If a village had less than 50 households, it was combined with an adjacent one for the convenience of drawing household samples. There were three such cases in our list of study villages.

Development Programmes : For the purpose of our study, we view development programmes broadly as any programmatic effort relating to the improvement of agriculture, education, the building of the physical infrastructure, the organization of farmers and youths etc., at the village level. This definition of development is guided by the way the Government of Bangladesh conceptualizes it in its planning of development programmes in different fields. Deduced from the First Five-Year Plan [4] any planned efforts, be it making new schools or health and MCH centres available to the villagers, or facilitating access to them by constructing approach roads, or arousing response to and participation in them, could be considered activities

[1]Although sociologically community and village do not carry the same connotation, we have used these two words interchangeably.

aimed at development. For example, the Government of Bangladesh planned to establish 5,000 new primary schools [4, pp. 441-96], and to increase the enrollment of children in schools[2] during the period 1973-78. According to our conceptualization, both the establishment of new schools and the increasing of enrollment in them would be regarded as developmental programmes for education.

Not all development programmes can be expected to be available right within the boundary of every village, of course, but can be differentially accessible to it. In order not to underestimate the availability of development programmes and services, we have taken both the availability and accessibility into account by measuring their distance to the villages in miles.

Family Planning Programme Efforts : Berelson and Mauldin [8, p.102] defined a family planning programme as an organized effort, typically governmental, to extend the effective practice of modern fertility control without direct or major efforts to affect the socio-economic determinants or the structure of demand. This definition seems to exclude governmental efforts to promote traditional means of contraception, which the Bangladesh programme officially encourages and promotes. Besides designated family planning clinics, the health centres and hospitals also provide family planning-related services in Bangladesh.

Our own definition is much wider than that offered by Berelson and Mauldin. Ours includes the promotion of traditional methods along with the modern ones. Because the Government of Bangladesh pursues an integrated approach to health and family planning, any health-related service is regarded as having family planning implications and is hence included in the estimation of the availability of family planning services in the rural area.

Given Environmental and Socio-economic Conditions of the Village : The given environmental and socio-economic conditions of the village refer to those factors that are found in the environment of the village, and are not the result of planned programmes to induce changes in them either from outside or from within the village—for example, distance of the village from means of water transportation, ownership of tin-roofed houses and land by the members of the village, or proportion of male population engaged in agriculture. Prior programmes may have influenced these factors but currently there are no direct attempts to change them. Level of education of the villagers is also considered as a given condition of the village. Although it is

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[2]For an elaborate discussion on various efforts to increase and retain enrollment of children in school, see Ellen Sattar [10].

an aggregation of past and present achievement, we want to treat achieved level of education as having occurred prior to the day of data collection and distinguish it from the developmental efforts towards establishment of schools and increasing enrollment of children in school and retaining them there.

Data

The data for the analysis have been drawn from the Bangladesh Fertility Survey, a project of the World Fertility Survey. As with all other World Fertility Survey projects, BFS is a single-round cross-sectional survey. The survey covered both rural and urban areas. It generated data at three levels for the rural area—villages, households, and individuals. This analysis uses data generated from 160 sample villages and 4,962 women, who are aged 10-49 and living in these villages. The village-level data in the BFS community survey were collected from persons in the villages regarded as being knowledgeable about them.

In addition to the data collected by the BFS field staff, the present researcher personally obtained from the 1974 Population Census supplementary data on some additional variables such as area, population, literacy, employment, etc., relating to the same 160 villages as those covered by the Community Survey of the BFS.

Independent Variables

We have 52 measures (listed in Appendix A) of characteristics of the villages. These 52 measures are reduced to 18 independent variables through the use of factor analysis (results of factor analysis are presented in Appendix B). The independent variables, according to their conceptual classification, are as follows :

(1) *Given Environmental and Socio-economic Conditions of the Village*

Farm Employment Index
Economic Condition Index
Education Level Index
Access to Means of Water Transportation Index
Availability of Newspaper*

(2) *Development Programmes of the Village*

Access to Education Institutions Index
Proportion of Families Sending their Children to School*
Level of Education for Children Desired

*Single item variable.

Modern Agri-Practices Index
Irrigation Facilities Index
Farmer's Organization Index
Access to Means of Road Transportation Index
Number of Radios Available*
Presence or Absence of Youth Organization*

(3) *Health and Family Planning Programmes of the Village*
Access to Thana-based Health and Family Planning Services
Extent of Health and Family Planning Workers' Visit to the Villages
Access to Local Health and Family Planning Services Index
Sanitation Facilities Index.

Dependent Variables

The dependent variables of our analysis and their measures are presented in Appendix Table C. 1. All of the variables except desired family size are measured in terms of proportions. It is interesting to note that there is a striking variation in knowledge of specific contraceptive methods across villages. The proportion of women who know condom, rhythm, douche, and abstention is lower than the proportion of women who know pill, IUD, female and male sterilization. On the average, one to three out of every ten women per village reported knowledge of condom, rhythm, douche, and abstention as methods of birth control. In contrast, about four to six out of every ten women per village reported knowledge about pill, IUD, male and female sterilization as methods of contraception.

In order to discern if there is an underlying pattern of relationship among the knowledge variables, we applied factor analysis to the dependent variables as we did to the explanatory variables. The results of the factor analysis presented in Appendix Table C.1 suggest three factors or components which are orthogonal to each other and would account for more of the variance in the data as a whole than any other set of three linear combinations. The resulting conceptual variables and constituent measures are as follows.

Factor Constructs of Dependent Variables	*Component Elements*
1. Levels of Knowledge of Clinical Contraceptive Methods	Proportion of Women Know Pill Proportion of Women Know IUD Proportion of Women Know Female Sterilization

* Single item variable.

	Proportion of Women Know Male Sterilization
	Proportion of Women Know Douche
2. Levels of Knowledge of Non-clinical Contraceptive Methods	Proportion of Women Know Condom
	Proportion of Women Know Rhythm
	Proportion of Women Know Withdrawal
	Proportion of Women Know Abstention
3. Levels of Contraceptive Practice	Proportion of Women Ever Used any Contraceptive Method
	Proportion of Women Currently Using Any Contraceptive Method

Desired family size and intentions to use contraception in the future are not included in these factors, because evidence for their inclusion seems weak. Furthermore, their theoretical interest indicates that they should be analyzed separately. So the present analysis is limited to the three major factors : (1) Knowledge of clinical contraceptive methods, (2) Knowledge of non-clinical Contraceptive methods, and (3) Contraceptive practice.

A short note on the naming of factor 1—Levels of Knowledge of "Clinical" Contraceptive Methods—is in order. It is so labelled because most of the constituent items—IUD, male and female sterilization—are clearly clinical methods. Pill can be either a clinical or a non-clinical method depending on where it is dispensed. In developed countries, pill is a clinical method as it must be prescribed by a physician after clinical examination ; in Bangladesh, however, it may be considered a "non-Clinical" method since it is sold over the counter and delivered to the clients by the field workers.

III. ANALYSIS AND RESULTS

To lay the groundwork for multivariate analysis and to identify the statistical techniques appropriate to our data, we started with a look at how the village level predictors, considered one at a time, relate to fertility measures (see Appendix D). Next, we examined the forms of relationship—whether they are linear and whether interaction is present. Absence of marked interaction and presence of non-linear relationships in the data suggest Multiple Classification Analysis as an appropriate statistical technique for the multivariate analysis of our data.

A two-step analysis is followed with three of our dependent variables. In the first step we ran subsetwise MCA (MCA of each of the three dependent variables with the three subsets of predictors separately) to choose the

"best" explanatory predictors to represent each subset. The predictors are selected partly on the basis of MCA *betas* and partly on the basis of assumed relative ease of policy manipulability of the predictors.

In the second step, we ran MCA with all of the selected "best" predictors taken together, subsetwise and in combination, so that we can estimate the joint and the net effects of development, family planning, and the given conditions of the village on the fertility-related measures we are analyzing.

We have two knowledge variables to analyze—one is knowledge of clinical contraceptive methods and the other is knowledge of non-clinical contraceptive methods. The former is an index composed of poroportions of women who know different clinical methods, and the latter is based on knowledge of different non-clinical methods. It is interesting in itself that the levels of knowledge of clinical and non-clinical methods vary strikingly. On the average, the proportion of women in a village who know a clinical method is at least three times larger than those who know a non-clinical contraceptive method. The proportion of women knowing clinical contraceptive methods ranges from .09 to .85 with a mean of .50 and the proportion of women knowing non-clinical contraceptive methods ranges from zero to .47 with a mean of .17.

Knowledge of Clinical Contraceptive Methods

Eight village level predictors were selected to explain the variation in knowledge of clinical contraceptive methods. Education level of the village and access to water transportation represent the given condition factor of the village. Mean education defined in completed years of schooling desired for children of the village, access to educational institutions, and presence of a youth club in the village represent development programmes. The family planning variables are availability of sanitation facilities, health and family planning workers' visits, and access to local health and family planning services.

The explanatory power of each of the subsets of predictors measured by squared multiple correlations (presented in Table I) show that "development" programme variables have the highest explanatory power and "family planning" variables the lowest. "Development" and "family planning" combined produce a squared multiple correlation of .206, which is higher than that of either of them alone or in combinations with given conditions. We note, however, that the combination of given conditions of the village and availability of development programmes does almost as good as that of development and family planning in explaining knowledge of clinical contraceptive methods. All of the eight variables together, as is expected, predict more than

the subsets separately. Taken together, all the predictors explain 33.1 per cent of the total variance ; when adjusted for degrees of freedom, they explain 24.6 per cent of the variance.

Marginal contribution is another estimate of how well a subset of predictors does in comparison with other subsets. Table II reports the marginal contribution to the squared multiple correlation of each of the subsets.

TABLE I

PROPORTION OF VARIANCE IN KNOWLEDGE OF CLINICAL CONTRACEPTIVE METHODS EXPLAINED BY SUBSETS OF PREDICTORS AND THEIR COMBINATIONS

Subsets of Predictors and Their Combinations	R^2 Unadjusted	R^2 Adjusted	Degrees of Freedom[a]
Given Condition Variables Only	.143	.121	4
Development Variables Only	.216	.180	7
Health and Family Planning Variables Only	.094	.053	7
All Variables Together	.331	.246	18
Development and Family Planning	.277	·206	14
Given Condition and Family Planning	.230	.173	11
Given Condition and Development	.257	.202	11

[a]As in this and similar other tables, the degrees or freedom is the number of categories minus the number of predictors.

TABLE II

MARGINAL CONTRIBUTION OF SUBSETS OF PREDICTORS TOWARDS THE FRACTION OF VARIANCE EXPLAINED IN KNOWLEDGE OF CLINICAL CONTRACEPTIVE METHODS

Marginal Contribution[a] of	R^2 Unadjusted	R^2 Adjusted
Given Condition of the Village	.054	.040
Development Programmes	.101	.073
Family Planning Programmes	.074	.044

[a]As in this and similar other tables, marginal contribution is the difference between R^2 of MCA with all variables and R^2 of MCA with variable or set of variables whose marginal contribution is of interest excluded from the run. For example, the marginal contribution of development variables is obtained by subtracting R^2 of Given Condition and family planning variables from the R^2 of all variables.

The marginal contribution of "development" is the highest of the three subsets of predictors. Compared to family planning, development contributes more towards explaining knowledge of clinical contraceptive methods.

We note that the sum of R^2 of the three subsets taken individually is greater than the R^2 of all three subsets together. This indicates that some of the predictors are correlated and part of the variation explained by one predictor could also be explained by other predictors. Examination of bivariate relationships reveals that mean education desired for children of the village, presence of youth club, achieved mean education for the village, and availability of sanitation facilities are positively related to one another.

The statistical measures of the relative strengths of the predictors in relation to the dependent variable, considering and neglecting the effects of other predictors, are denoted by *beta* and *eta* respectively : they are reported in Table III.

TABLE III

RANK ORDER OF PREDICTORS BY MCA *BETA* VALUE FOR KNOWLEDGE OF CLINICAL CONTRACEPTIVE METHODS

Rank Order	Predictors	$Eta_{(i)}$	$Beta_{(j)}$	Significance[a] Test $F_{(i)}$
1.	Mean Education Desired for Children	.39	.28	15.2**
2.	Access to Means of Water Transportation	.22	.24	2.78*
3.	Availability of Sanitation Facilities	.27	.22	6.35**
4.	Health & Family Planning Worker Visit	.14	.21	1.02ns
5.	Access to Local Health and Family Planning Services	.07	.20	.34ns
6.	Access to Educational Institutions	.21	.20	3.5*
7.	Youth Club	.24	.16	5.0**
8.	Mean Education Level	.31	.15	16.67**

*Significant at $P \leq .05$

**Significant at $P \leq .001$

ns = not significant.

[a]Here and elsewhere in similar tables, $F_{(i)}$ tests whether an *eta* is significant under the null hypothesis that predictor i, taken by itself, has no effect on variance in the criterion variable.

F-test of *eta* statistics indicate that except family planning workers' visit and access to local health and family planning services, all other variables by themselves significantly correlate with knowledge of clinical contraceptive methods. However, in the multi-variate context, family planning workers' visit and access to local health and family planning services, rank fourth and fifth respectively in relation to other predictors. The rank order of the predictors shows that the most discriminating predictor for knowledge of clinical contraceptive methods is mean education desired for children of the village. It needs to be noted that mean education desired for children and proportion of families sending their children to school are themselves correlated (the coefficient being .45).

The variation in the dependent variable across categories of the predictors is assessed by making comparisons of the category means with the grand mean, which is .50. The zero-order relationship is assessed by subtracting the grand mean from the category mean for each category, and the net effect is assessed by the adjusted coefficient for each category. Table IV presents the gross and net MCA coefficients.

Education level and access to means of water transportation, indicators of given conditions of the village, are both positively related to knowledge of clinical contraceptive methods. These indicators may represent different channels of exposure to "modern" ideas. Net effects show that the key difference is between low and medium or high access to transportation.

All indicators of development programmes have positive impact, although villages with high access to educational institutions tend to be lower on knowledge than those with medium access. The mean education desired for children is positively related to knowledge ; so is the presence of a youth club. Development programmes seem to influence aspirations and also introduce modern ideas, affecting people's motivations to find out about contraception.

Health and Family planning efforts do not seem to have much effect relative to the other two factors. However, the positive effects of "many" visits of FP workers programmatically imply that field workers have potentials for affecting people's knowledge about means of fertility control. Although it is not clearly understood how availability of sanitation facilities, such as availability of tubewells for drinking water and sanitary latrines, affects people's knowledge of contraceptive methods, this study provides evidence of its significant impact on knowledge.

The net effects of level of education desired for children of the village, achieved mean education of the village, presence of youth club, and availability of sanitation facilities, need to be weighed with caution. They are related to one another. Though the multicolinearity is not high and MCA

can handle correlated predictors, the possibility of bias should not be ruled out. For example, the effect of mean level of education desired for children may not be its "true" effect on knowledge ; some bias due to its correlation with the achieved education of the village might have been added to it.

Knowledge of clinical contraceptive methods is related to multiple factors-development, family planning, and given conditions of the village. Over all,

TABLE IV

MULTIPLE CLASSIFICATION ANALYSIS OF KNOWLEDGE OF "CLINICAL" CONTRACEPTIVE METHODS

CONSTANT = $\bar{Y}$=.50

Predictors	Class Mean	Unadjusted Deviation from Grand Mean	Coefficient	Adjusted Mean	≠ Cases
Education Level					
High	.545	.046	.022	.522	82
Low	.451	−048	−.023	.476	78
Access to Means of Water Transportation					
High	.540	.041	.025	.525	50
Medium	.504	.005	.027	.527	50
Low	.469	−.031	−.035	.464	51
$\bar{X}$Desired for Children					
High Education	.552	.052	.027	.526	79
Low Education	.456	−.043	−.019	.481	79
Youth Club					
Have Youth Club	.546	.047	.031	.531	61
Don't Have Youth Club	.474	−.025	−.018	.481	88
Access to Educational Institutions					
High	.523	.024	.008	.508	46
Medium	.534	.035	.026	.526	52
Low	.456	−.044	−.013	.486	50
Extent of Health and FP Worker Visit					
High	.530	.030	.014	.513	50
Medium	.487	−.013	−.026	.473	50
Low	.488	−.011	−.009	.490	50
Access to Local Health and FP Services					
High	.509	.009	−.011	.488	86
Low	.490	−.010	−.002	.497	65
Sanitation Facilities					
High	.532	.032	.014	.514	67
Low	.504	.005	.016	.516	64

development factors play a greater role in predicting variations in knowledge of clinical methods across the villages than do family planning and given conditions of the village. The evidence suggests that influencing such development factors as access to schooling facilities, youth club and children's education seem likely to contribute to the level of kowledge of means of birth control, which we shall find later has influence on contraceptive practice.

Knowledge of Non-clinical Contraceptive Methods

Based on their performance in the subsetwise MCA, nine explanatory variables were selected to analyze knowledge of non-clinical contraceptive methods. Availability of irrigation facilities in the village, mean level of education desired for children of the village, access to educational institutions and modern agricultural practices represent "development" programmes of the village. Access to Thana-based health and family planning services, family planning workers' visit and local health and family planning services represent "family planning" efforts. Given conditions of the village are represented by employment and education level of the village.

Table V presents the percentage of total variance in the knowledge of non-clinical contraceptive methods at the village level which is explained by each of the subsets of explanatory variables—given condition, development, and family planning programmes and their combinations. All the above nine variables taken together explain 30 per cent of the variance in knowledge of non-clinical methods in the present data and an estimated 19 per cent for the population of villages as a whole. Of the three subsets, "develoment" accounts for the highest percentage of variance, closely followed by family planning and then by given conditions of the village. The joint explanatory power of all the variables, as can be seen in Table V, is greater than that of any of the subsets considered separately or their combinations. Of the

TABLE V

PROPORTION OF TOTAL VARIANCE IN KNOWLEDGE OF NON-CLINICAL METHOD OF CONTRACEPTIVES EXPLANED BY SUBSET OF PREDICTORS AND THEIR COMBINATIONS

Subset of Predictors and Their Combinations	R^2	R^2 Adjusted	Degrees of Freedom
Given Condition Variables Only	.139	.116	4
Development Variables Only	.150	.092	10
Health and Family Planning Services	.118	.071	8
All Variables Together	.298	.186	21
Development and Family Planning	.231	.132	18
Given Condition and Family Planning	.221	.158	12
Given Condition and Development	.229	.154	14

three combinations, no one does strikingly better than any other ; they explain nearly the same amount of variance.

The given condition of the village makes the largest relative contribution to the prediction of knowledge of non-clinical methods. Both development and family planning have independent effects but their magnitude is about the same in predicting the knowledge of non-clinical contraceptive methods. The marginal contribution of each of the subsets of variables is presented in Table VI.

A note about the positive overlap across subsets of predictors in relation to knowledge of non-clinical contraceptive methods is in order, as it was in the case of knowledge of clinical contraceptive methods. Mean education desired for the children and education level of the village, on the one hand, and access to educational institutions and access to health and family planning service facilities, on the other, are significantly correlated. The degree of relationships is not very high ; they range from .42 to .51. Because these predictors across subsets relate to one another, the joint predictive power of the predictors is less than the sum of the three subset of predictors, taken separately.

TABLE VI

MARGINAL CONTRIBUTION OF SUBSETS OF PREDICTORS TOWARDS THE FRACTION OF VARIANCE EXPLAINED IN KNOWLEDGE OF NON-CLINICAL CONTRACEPTIVE METHODS

Marginal Contribution of	R^2	R^2 Adjusted
Given Condition of the Village	.067	.054
Develoment Programmes	.077	.028
Family Planning Programmes	.069	.032

The relative importance of the variables, estimated by MCA *betas*, is shown by the rank order in Table VII. The *eta* statistics indicate that employment in agriculture, access to service facilities such as health and family planning, education, field workers' visits, and mean education desired for children of the village, by themselves, each explain a significant proportion of the variance of the knowledge of non-clinical contraceptive methods.

Table VIII reports the unadjusted and the adjusted coefficients. Education level and mean education desired for the children, by themselves, are positively related to knowledge of non-clinical contraceptive methods. But controlling for other variables, the effect of education is near zero and that of mean education desired for children is reduced. This pattern of effects is

expected on two counts : (a) overlap of the two education-related variables, and (b) given the average level of 3 ± 2 years of education of the village and their predominant agrarian environment, it is expected that agriculture-related variables would have a dominating effect over education.

TABLE VII

MCA *BETA* RANK ORDER OF PREDICTORS FOR KNOWLEDGE OF NON-CLINICAL CONTRACEPTIVE METHODS

Beta Rank	Predictors	$Eta_{(i)}$	$Beta_{(j)}$	Significance Test $F_{(i)}$
1	Employment Level	.31	.27	5.5**
2	Modern Agricultural Practices	.20	.23	2.08ns
3	Access to Health and Family Planning Services	.24	.22	3.2*
4	Health and Family Planning Worker	.25	.20	3.46*
5	Xedn Desired	.27	.19	6.20**
6	Access to Educational Institutions	.25	.13	3.46*
7	Education Level	.22	.13	7.67**
8	Access to Local Health and Family Planning Services	.06	.11	.24ns
9	Irrigation Facility	.06	.09	34ns

*Significant at $P \leq .05$

**Significant at $P \leq .01$

ns = not significant.

In a predominantly rural agrarian society like Bangladesh, the impact of agriculture-related variables on fertility-related phenomena is considered to be of great policy relevance particularly, in the wake of current emphasis on agricultural development. We have three agriculture-related variables : (a) employment in agriculture defined in terms of proportion of male population engaged in agricultural activities, (b) modern agriculture practices, such as use of chemical fertilizer, new seed varieties, and insecticides, and (c) availability of irrigation facilities for agriculture.

Availability of irrigation facilities has no effect on knowledge of non-clinical contraceptive methods, but employment in agriculture and modern agricultural practices have the largest effects in the regression equation. To elaborate, 'high agriculture employment' villages have lower than the average knowledge. In fact, villages where the highest proportion of male population is employed in agriculture activities have the lowest knowledge. Modern agricultural practices have positive effects on knowledge. The slight negative coefficient for "high agricultural practices" villages may be a function of skewed distribution and poor measurement of the variable. High employment in agriculture along with low input of modern agricultural practices may indicate that these villages are less accessible to "modernizing" activities and distantly located from the means of transportation

and service locations, and that family planning workers' visits are fewer. The evidence for an effect of modern agricultural practices on knowledge implies that providing agriculture development to these types of village may affect the level of knowledge.

TABLE VIII

MCA OF KNOWLEDGE OF NON-CLINICAL CONTRACEPTIVE METHODS

CONSTANT $\Xi \bar{Y} = .17$

Predictors	Class Mean	Unadjusted Deviation from Grand Mean	Coefficient	Adjusted Mean	# Cases
Employment Level in Agriculture					
High	.141	−.030	−.024	.158	49
Medium	.203	.031	.024	.196	49
Low	.189	.017	.017	.189	49
Education Level					
High	.194	.022	−.013	.185	82
Low	.149	−.023	−.014	.159	78
Irrigation Facilities					
Have	.164	−.008	−.013	.159	54
Don't Have	.174	.002	.006	.178	83
$\bar{X}$edn Desired for Children					
High	.198	.026	.017	.189	79
Low	.145	−.023	−.014	.158	79
Access to Educational Institutions					
High	.184	.012	−.006	.166	46
Medium	.200	.027	.019	.191	52
Low	.145	−.027	−.009	.163	50
Modern Agri-Practices					
High	.172	.0002	−.009	.163	47
Medium	.200	.028	.023	.195	46
Low	.158	−.014	−.029	.143	46
Access to Thana-based Health & FP Services					
High	.182	.009	−.001	.171	50
Medium	.196	.024	.027	.200	50
Low	.153	−.019	−.013	.159	49
Extent of Health and FP Worker Visit					
High	.208	.036	.024	.196	50
Medium	.152	−.020	−.028	.144	50
Low	.165	−.007	.006	.179	50
Access to Local Health and FP Services					
High	.177	.005	−.002	.171	86
Low	.168	−.004	−.004	.168	65

Accessibility to service facilities has effects on knowledge, but the pattern is puzzling. It is not clear why the villages with medium accessibility should have higher knowledge than those with either higher or lower accessibility.

We observe the same pattern of relationship of health and family planning worker's visits to knowledge of non-clinical contraceptive methods as we did with knowledge of clinical methods. Those villages where there were many visits tend to have much higher knowledge than the others, even when we consider the effects of other predictors.

Given conditions such as employment in agriculture and village education level explain more variation in knowledge of non-clinical contraceptives than the factors of development and family planning programmes. Of the development variables, modern agricultural practice is the strongest predictor and ranks second in order of multivariate importance. The findings suggest that agriculture development activities have potential to influence knowledge of contraceptive means.

Contraceptive Practice

Contraceptive practice in Bangladesh villages is low—on the average, proportion of women who have ever practiced contraception is .11. Even within this low level, there is considerable variation from one village to another ; the proportion of ever users of contraception varies from zero to .47. Understanding of why contraceptive practice varies from one village to another is one of our key concerns in this analysis. On the basis of the results of subsetwise MCA analysis, eight predictors were chosen. They are : access to means of water transportation and employment level to represent given condition of the village ; access to means of road transportation, number of radio sets available, and presence or absence of a youth club to represent development programmes and extent of family planning worker's visits to the village, and access to local and Thana-based health and family planning services to represent family planning service accessibility and availability to the village. Relative effects of each of these subsets, their combinations, and their component predictors in predicting contraceptive practice at the village level are examined in this analysis.

Table IX presents the results of MCA analyses of the effects of the three subset of predictors on contraceptive practice. "Development" and "family planning" have almost equal effects on contraceptive practice at the village level. The combined effects of development and family planning are greater than either of them separately, and greater than any other combination among the three subsets. The variance in contraceptive practice explained by development and family planning programme variables combined is 16.2

per cent. As can be seen in the table, the joint effect of all the predictors together is more than the effect of each of the subsets alone, or their combinations.

TABLE IX

PROPORTION OF VARIANCE IN PRACTICE OF CONTRACEPTION EXPLAINED BY SUBSET OF PREDICTORS AND THEIR COMBINATIONS

Subset of Predictors and Their Combination	R^2	R^2 Adjusted	Degrees of Freedom
Given Condition Variables Only	.086	.050	6
Development Variables Only	.127	.087	7
Health and Family Planning Variables Only	.125	.078	8
Knowledge Variables Only	.224	.214	2
All Variables Including 2 Knowledge Variables	.440	.350	23
All Variables Without 2 Knowledge Variables	.309	.204	21
Development + Health and Family Planning Variables	.241	.162	15
Given Condition + Health and Family Planning Variables	.204	.127	11
Given Condition + Development Programme Variables	.212	.141	18

In the family planning literature, there is ample evidence that contraceptive practice is affected by knowledge of different means of contraception. In order to find if that holds at the village level, we added the two knowledge variabels—knowledge of clincical and non-clinical contraceptive methods—as independent variables in our analysis of contraceptive practice. In confirmation, the knowledge variables become the strongest predictors of contraceptive practice. They alone explain 21·4 per cent of the variance in contraceptive practice. When the two knowledge variables are added to the other eight predictors, the multiple correlation (R^2 unadjusted) with contraceptive practice jumps up to .44, as compared to .309 without them.

Table X presents the net contribution of subset of predictors. As indicated by marginal contributions, the independent effect of "development" is greater than that of "family planning" and "given conditions" factors of the village. Compared to family planning, development tends to do better but not remarkably so. The net contribution of knowledge of clinical and non-clinical contraceptive methods to contraceptive practice far exceeds the independent contribution of any other subset of predictors.

The summary statistics of *eta* and *beta* for each predictor are shown in Tables XI and XII, the latter with and the former without the knowledge variables.

The MCA *betas* presented in descending order in Table XI indicate that of all classifications, extent of health and family planning workers' visits, access to means of road and water transportation, and the number of radios available in the village, are the best predictors.

TABLE X

MARGINAL CONTRIBUTIONS OF SUBSETS OF PREDICTORS TO THE FRACTION OF VARIANCE EXPLAINED IN PRACTICE OF CONTRACEPTION

Marginal Contribution of	R^2	R^2 Adjusted
Given Condition of the Village	.068	.042
Development Programmes	.105	.077
Health and Family Planning Programmes	.097	.063
Knowledge of Contraceptive Methods	.131	.146

Comparing Table XI with Table XII we find that the relative importance of predictors has changed, but not dramatically. The knowledge of non-clinical contraceptive methods becomes the most important indicator

TABLE XI

RANK ORDER OF PREDICTORS BY MCA *BETA* VALUE FOR CONTRACEPTIVE PRACTICE WITHOUT KNOWLEDGE VARIABLES

Rank Order	Predictors	$Eta_{(1)}$	$Beta_{(1)}$	Significance Test $F_{(1)}$
1.	Extent of Family Planning Worker Visit	.33	.33	6.17**
2.	Access to Means of Road Transportation	.29	.32	6.17**
3.	Access to Means of Water Transportation	.23	.31	2.9*
4.	Number of Radios Available	.13	.15	4.07*
5.	Employment Level in Agriculture	.17	.13	1.59ns
6.	Youth Club	.09	.11	.52ns
7.	Access to Local Health and Family Planning Services	.06	.10	.33ns
8.	Access to Thana-based Health and Family Planning Services	.15	.10	1.2ns

*Significant at $P \leq .05$
**Significant at $P \leq .001$
ns = not significant.

followed by indicators of transportation and family planning workers' visits. Family planning workers' visit is the highest ranking predictor without knowledge variables ; with their addition, its effect shrinks and the relative ranking drops down to fourth. Nevertheless, the family planning worker still has substantial independent effect. And, besides the direct effect, the family planning worker also has indirect effects through knowledge.

Table XIII provides us an opportunity for a closer examination of the nature and extent of effects of the predictors on contraceptive practice at the village level. As is seen in the table, there is not much change in the gross

effects when other predictors are held constant. Accessibility to the means of transportation has a positive effect on contraceptive practice. The relationship of contraception with access to means of transportation suggests that development of rural transportation infrastructure has demographic implications. About a decade ago Berelson [3] foresaw such an association and argued for "beyond family planning."

TABLE XII

RANK ORDER OF PREDICTORS BY MCA *BETA* VALUE FOR CONTRACEPTIVE PRACTICE WITH KNOWLEDGE VARIABLES

Rank Order	Predictors	*Eta* $_{(i)}$	*Beta* $_{(j)}$	Significance Test$_{(i)}$
1.	Knowledge of Non-clinical Contraceptive Methods	.45	.34	17.65*
2.	Access to Road Transportation	.29	.30	4.90**
3.	Access to Water Transportation	.23	.28	2.88*
4.	Health and Family Planning Worker Visit	.33	.25	3.53*
5.	Access to Local Health and Family Services	.06	.14	.35ns
6.	Number of Radios Available	.13	.13	1.37ns
7,	Knowledge of Clinical Contraceptive Methods	.32	.13	41.56**
8.	Youth Club	.09	.10	.59ns
9,	Employment Level	.17	.10	1.59ns
10,	Access to Thana-based Health and Family Planning Services	.15	.04	.11ns

*Significant at $\leqslant$.05
**Significant at $\leqslant$.001
ns = not significant.

The family planning worker has both direct effects on contraceptive use and indirect effects through knowledge. The villages where the family planning worker visited "many" times during the last year have much greater than average contraceptive use ; no visit or some visits are associated with much lower than the average contraceptive practice of the village.

The effect of radios on contraceptive practice is interesting. The villages where large numbers of radios (more than 10 but less than 71) are available the mean contraceptive practice is less than the grand mean. Does this mean that the villages having large numbers of radios are better off than those having no or less numbers of radios. and that better-off villages tend to practice contraception less ?

TABLE XIII
MCA OF CONTRACEPTIVE PRACTICES (KNOWLEDGE VARIABLES INCLUDED)
$\bar{Y}=.11$

Predictors	Class Mean	Unadjusted Deviation from Grand Mean	Coefficient	Adjusted Mean	No. Cases
Knowledge of Non-clinical Contraceptive Methods					
High	.156	.046	.035	.145	75
Low	.069	−.040	−.031	.079	85
Access to Means of Road Transportation					
High	.148	.038	.041	.151	51
Medium	.098	−.012	−.018	.092	51
Low	.081	−.029	−.011	.090	50
Access to Means of Water Transportation					
High	.121	.110	.005	.115	50
Medium	.096	−.014	−.017	.092	50
Low	.108	−.010	−.006	.104	51
Health and Family, Planning Workers, Visits					
Many	.151	.041	.028	.138	50
Some	.081	−.029	−.023	.086	50
None	.092	−.018	−.012	.098	50
Access to Local Health and Family Planning Services					
Within the Village	.106	−.004	−.008	.102	86
Outside the Village	.112	.002	.015	.125	65
No of Radios Available					
0—10	.119	.009	.011	.121	90
11—70	.092	−.018	−.012	.098	52
Knowledge of Clinical Contraceptive Methods					
High	.141	.031	.012	.122	78
Low	.081	−.029	−.012	.098	82
Youth Club					
Have	.120	.010	.008	.118	61
Don't Have	.104	−.006	−.002	.108	88
Employment Level in Agriculture					
High	.091	−.019	.002	.112	49
Medium	.132	.022	.006	.116	49
Low	.106	−.004	−.012	.098	
Access to Thana-based Health and Family Planning Services					
High	.115	.005	−.005	.105	50
Medium	.125	.015	.003	.113	50
Low	.091	−.019	−.007	.110	49

There is one school of thought which argues that availability of and accessibility to family planning services will trigger contraceptive practice [9]. Earlier studies have also provided evidence to the effect that accessibility of contraceptive supplies has a powerful direct influence on contraceptive behaviour [7]. We have objective measurements of availability and accessibility of family planning services in the distances of the health and family planning related service facilities from the villages they serve. On the average, the family planning service facilities are seven miles away from the villages being served. We examined whether contraceptive practices are different by village depending on health and family planning service location. Multiple classification analysis indicates that accessibility of villages to service locations has an effect on the use of contraception, but that when the effects of other predictors are taken into account, this effect becomes unimportant. However, village access to road transportation system, which is intercorrelated with village access to service locations, is found to be positively associated with level of contraceptive use.

The impacts of knowledge of both clinical and non-clinical contraceptive methods are positive both before and after controlling for the effects of other predictors. The higher ranking of knowledge of non-clinical contraceptive methods deserves explanation. This is perhaps a reflection of the pattern of knowledge of different types of contraceptive methods and their use at the individual level. The relative use of clinical and non-clinical contraceptive methods is the exact opposite of the relative knowledge of these methods. The rate of knowledge of clinical methods ranges from 29 to 63 per cent, while that of non-clinical methods, from 10 to 27 per cent. Seventy per cent of the ever-users of contraception have used at least one of the non-clinical contraceptive methods, while 43 per cent have used at least one of the clinical methods. Most ever users know both clinical and non-clinical methods and most non-users, clinical methods only. But the ever users, who are likely to know both clinical and non-clinical methods, are more likely to have used non-clinical rather than clinical methods.

Those villages where there are youth clubs tend to have a higher level of contraceptive practice than the villages where there are no such organizations. Such evidence for an effect of youth clubs on contraception supports the Ministry of Social Welfare programmes in organizing rural youths and involving them in population control activities.

To sum up, both "development" and "family planning" programmes have independent effects on contraceptive use ; development tends to do better than family planning. Either of them separtely is not likely to have as much of an effect on contraception as both of them jointly would. The villages that have high levels of knowledge of the means of contraception, are close

to the system of transportation, have a youth club, or have been visited many times by family planning workers, are the ones that have higher levels of contraceptive practice than other types of villages. Not all development programmes, at least the way we have defined them for this study, have effects on fertility-related measures in the expected direction. The effect of number of radios available on contraception is a case in point. In villages where there are a large number of radios available, the contraceptive practice is lower than in the villages where there are fewer or no radios available. This could, however, be a reflection of a social class effect rather than the effect of radios *per se.*

IV. POLICY IMPLICATIONS

A number of policy implications emerge from the findings of the study.

Our analysis suggests that both development and family planning efforts have independent and approximately equal influence on contraception in Banladesh villages ; each of them separately is not likely to have as much of on contraceptive use as both of them jointly would have. Clearly, the policy implication of this finding is that if both development and family planning programmes are provided to the villages, the impact on fertility may be maximized. It further implies that population planning is one aspect of development planning and is required to be regarded as part of a series of concerted development endeavours that would affect social change and thereby reinforce the need for fertility control and regulation.

Development programmes relating to the availability of schooling facilities and promotion of education for children, organization of youth activities, agricultural development, and improvement of transportation systems present evidence of potentialities for reinforcing the efforts of family planning programmes.

Desired education for children, rather than achieved education of the village, stands out as one of the most important factors affecting village-level knowledge of means of fertility control—both clinical and non-clinical—which in turn, is significantly related to contraception. Education in Bangladesh is at a low level and girls are much less likely to be educated in the villages than the boys. And even when they are educated, the girls tend to have lower levels of education than the boys.

One of the few established facts in relation to family planning appears to be that it is much more likely to be practiced by the educated than the uneducated. Our data bear out the proposition. At the village level, achieved as well as desired education, and access to educational institutions, are significantly associated with women's knowledge of contraceptive methods, which, again, is strongly related to their practice of contraception. At the

individual level, those women who have even a little education (1-5 years of schooling) are most likely to know and use contraception than the uneducated ones.

Probably the most important of all development programmes is that of education, because it impinges upon every aspect of development. Village life would not remain so unchanged as it is, if education progressed. There is no doubt that education should be promoted and educational efforts should be concentrated on primary education rather than on expanding higher education still further.[3] Promoting at least primary level education especially among the girls, is desirable not only for the pure virtues of development, but also for the attendant demographic goal of lower fertility.

The relationship of contraception with access to the transportation system suggests that development of the rural transportation infrastructure is likely to have demographic implications. The closer the road transportation system is to the villages, the higher is the level of contraceptive use. A similar relationship is observed between contraception and distance of the system of water transportation. Such relationship persists at the individual level even when individual's own and other village characteristics are held constant [1].

In order to minimize the problem of distance to services and supplies, family planning workers are employed to make visits to houses of the eligible couples. Family planning worker's visits have direct effects on contraception as well as indirect effects through knowledge. The villages where the family planning worker visited "many" times (at least once a month during the last year) have very high levels of contraceptive use ; no visit or less than one visit a month, on the contrary, is associated with much lower than average contraceptive practice in the village. Family planning worker's visits to the village is also an important predictor of contraception at the individual level. Women residing in villages where family planning worker made "many" visits use contraception more frequently than those residing in villages where family planning workers made no or few visits [1]. An example of field worker's potentialities could be drawn from the performance of visiting workers involved in household distribution project in Matlab Thana. The experiment in household distribution of contraceptives undertaken in Matlab Thana in Comilla has achieved around 17 to 18 per cent of married couples in the reproductive ages using contraceptives supplied to them [2].

Agriculture is the mainstay of economic life in Bangladesh. As much as 90 per cent of the total population live in the rural areas ; over 80 per cent of all employment is in agriculture. Employment in agriculture is the most signi-

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[3] The First Five Year Plan, for instance, proposed that enrollment in universities should be increased in five years by 60 per cent and in colleges by 52 per cent. See [4, pp. 465 and 476].

ficant factor that negatively affects knowledge of contraceptive methods, especially non-clinical contraceptive methods. The villages were the largest proportion of the male population is engaged in agriculture employment, have the lowest levels of knowledge. In contrast to the negative effects of employment in agriculture, modern agricultural practices have positive effects on knowledge of non-clinical contraceptive methods.

It might be repeated here that knowledge of non-clinical contracepttive methods is the most powerful predictor of contraceptive practices among the rural women. Socially and religiously, non-clinical contraceptives may be more acceptable to the villagers. Involvement of agricultural extension channels, for reinforcing the efforts of family planning programmes would, therefore, seen to be a useful strategy.

The youth organization, a development input to the village, also demonstrated importance. Those villages where there are youth organizations tend to have higher levels of knowledge and practice of contraception and also lower fertility norms than the villages where there is no such organization.

Village-level organizations, such as youth clubs and farmers cooperative societies, can play an important role in changing local norms and power structures and in addressing the whole range of social concerns. With the clinic providing back-up technical service and field workers performing service-delivery functions, involvement of local organizations could be a mechanism to organize the community, not only for population activities but also for other development programmes. The encouraging experience of Banjar, a local level organization on the Indonesian Island of Bali, and of the Mother's Club in Korea, in promoting the efforts of family planning, further indicates the potential of this strategy for Bangladesh.

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Appendix A

LIST OF VILLAGE-LEVEL MEASURES

1. Per cent of Families Owning Tin-roofed Houses
2. Per cent of Families Owning Land
3. Per cent of Total Male Population Working
4. Per cent of Total Female Population Working
5. Per cent of Total Male Population in Agricultural Labour Force
6. Distance (in Miles) to Nearest Paved Road
7. Distance (in Miles) to Nearest Bus Station
8. Distance to Nearest Raiway Station
9. Distance to Nearest Steamer Station
10. Distance to Nearest Launch Station
11. Distance to Madrasa (Religious Educational Institute)
12. Distance to Primary School
13. Distance to Boy's High School
14. Distance to Girl's High School
15. Distance to College
16. Per cent of Total Population Literate
17. Per cent of Total Male Population Literate
18. Per cent of Total Female Population Literate
19. Years of Schooling for Women Aged 10-49
20. Years of Schooling for the Husbands
21. Per cent of Women Aged 10-49 Literate
22. Per cent of Husbands Literate
23. Average Years of Schooling for Husband and Wife

24. Number of Tubewells Available fo Drinking Water
25. Number of Sanitary Latrines Available
26. Distance to Dispensary
27. Distance to Pharmacy
28. Distance to Health Clinics
29. Distance to MCH Clinic
30. Distance to FP Clinics
31. Distance to Qualified Doctor
32. Distance to Nurse
33. Distance to Thana Center
34. Distance to Dai (Traditional Midwife)
35. Distance to Kabiraj (Folk Doctor)
36. Distance to Other Doctors
37. Number of Times Vaccination Team Visited the Village During the Last 12 Months
38. Number of Times Family Planning Team Visited the Village During the Last 12 Months
39. Number of Times Malaria Team Visited the Village During the Last 12 Months
40. If Village has Thana Irrigation Project (TIP) or Not
41. If Village has Cooperative Society or Not
42. Number of Times Agriculture Worker Visited the Village During the Last 12 Months
43. If the Village has Deep Tubewell for Irrigation
44. If Village has Shallow Tubewell for Irrigation
45. Per cent of Families Using Chemical Fertilizers
46. Per cent of Families Using New Seed Variety
47. Per cent of Families Using Insecticides
48. Number of Radio Sets Available in the Village
49. Newspaper Available or Not
50. Presence or Absence of Youth Club in the Village
51. Proportion of Families Sending Their Children to School.

Appendix B

INTERRELATIONSHIPS OF EXPLANATORY VARIABLES

All the village level, explanatory variables are first classified into seven groups : (a) Given Environmental and Socio-economic Status of the Village, (b) Transportation Facilities, (c) Communication Facilities, (d) Education and

Educational Institutions, (e) Agricultural Development, (f) Health, Sanitation, and Family Planning, and (g) Youth Organization of the Village. These groupings are meant to reflect the broad dimensions of village environment including the development dimensions in which we have a special interest. They are, however, not mutually exclusive.

To test whether the variables within each group are independent or whether some underlying pattern of relationship exists among them, we subjected those variables measured in an interval scale to factor analysis.

Factor analysis techniques enable us to see whether there is an underlying pattern of relationships among a set of variables such that the data may be "reduced" to a smaller set of factors or components that may be taken as source variables accounting for the observed interrelations in the data.

Index Construction

Each factor is represented by a composite index, which is constructed by multiplying each of the variables that had a loading of greater than or equal to 130 in a factor by their respective factor score (raw score) coefficients, summing them up, and dividing by the sum of the weights of the variables involved. Mathematically, it can be expressed as follows :

$$\frac{\Sigma V_i \, Wt_{vi}}{\Sigma wt_i} = \frac{V_1 \times Wt_{V1} + V_2 \times Wt_{V2} + V_3 \times Wt_{V3} + V_4 \times Wt_{V4}}{Wt_{V1} + Wt_{V2} + Wt_{V3} + Wt_{V4}} = \text{Index}$$

where

V_i = Actual value of the variable i

Wt_{Vi} = Factor score coefficient (raw score form) of the variable i

ΣWt_{Vi} = Sum of the factor score coefficients of the number of variables involved.

In the construction of the index, the cases with missing data[1] were taken out ; thus, the resulting indices are based on complete cases with valid data except for two indices : Access to Thana-based Health and Family Planning Services, and Access to Local Health and Family Planning Services. The Access to Thana-based Health Services index was not constructed for a case only if five or more of its eight constituent items had missing data ; and the Access to Local Health Services index was not constructed for a case only if, out of its four input variables, three or more had missing data.

[1]See Table B.1 for number of input variables and missing data in the indices.

TABLE B.1

NUMBER OF INPUT VARIABLES AND MISSING DATA IN INDICES

Name of Indices	Number of Input Variables	Minimum Number of Input Variables on Which Index is Based
V268 —Knowledge of Clinical Contraceptive Methods	5	5
V269 —Contraceptive Practice	2	2
V270 —Knowledge of Non-Clinical Contraceptive Methods	4	4
V271 —Employment in Agriculture	2	2
V272 —Economic Condition	2	2
V273 —Education Level	8	5
V274 —Distance to Educational Institutions	3	3
V275 —Modern Agricultural Input	3	3
V276 —Irrigation Facilities	3	3
V277 —Farmers' Organization	2	2
V278 —Distance to Health and Family Planning Services	7	4
V279 —Extent of Health and Family Planning Workers' Visit to the Village	3	3
V280 —Distance to Local Health and Family Planning Services	4	3
V281 —Sanitation Facilities Available	2	2
V284 —Access to Means of Road Transportation	3	3
V285 —Access to Means of Water Transportation	2	2

TABLE B.2

FACTOR ANALYSIS (VARIMAX) OF VILLAGE-LEVEL SOCIO-ECONOMIC STATUS VARIABLES

Measures	Factor Loadings			
	1 Employment in Agriculture	2 Economic Condition	3 Female Employment Level	Per cent Variance Explained
V199 —Per cent Families Own Home	—.20	.37*	.26	25
V261 —Per cent Families Own Land	.07	.46*	—.06	22
V195 —Per cent Males Working	.75*	—.20	.30	69
V196 —Per cent Females Working	.14	—.001	.51*	28
V197 —Per cent Males in Agricultural Labour	.75*	.14	.03	58
Factor Contributions :				
To Total Variance in Per cent	24	8	8	40
To Explained Variance in Per cent	60	20	20	100

*Factor score coefficients (raw score form) of the starred variables in each factor were used in creating the index.

TABLE B.3

FACTOR ANALYSIS (VARIMAX) OF VILLAGE-LEVEL TRANSPORTATION FACILITY VARIABLES

Measures	Factor Loadings		
	1 Access to Means of Road Transportation	2 Access to Means of Water Transportation	Variance Explained in Per cent
V20 —Distance to Nearest Paved Road	.93*	.04	86
V21 —Distance to Nearest Bus Station	.84*	.09	72
V22 —Distance to Nearest Railway Station	.46*	—.09	22
V23 —Distance to Nearest Steamer Station	—.01	.65*	43
V24 —Distance to Nearest Launch Station	—.01	.91*	81
Factor Contributions :			
To Total Variance in Per cent	36	24	60
To Explained Variance in Per cent	60	40	100

*Factor score coefficients (raw score form) of the starred variables in each factor were used in creating the index.

TABLE B.4

FACTOR ANALYSIS (VARIMAX) OF EDUCATION AND EDUCATIONAL INSTITUTIONS VARIABLES

Variables	Factor Loadings					
	1 Education Level	2 Access to Educational Institutions	3 Village Literacy	4 Access to Madrasa	5 Village Women Education	Per cent Variance Explained
V 92 —Distance to Madrasa	—.02	.15	—.10	.59	.01	38
V 98 —Distance to Primary School	—.01	—.01	.01	.01	.14	5
V100 —Distance to Boys' High School	—.06	.84*	—.05	.22	.03	77
V102 —Distance to Girls' High School	—.05	.95*	.02	.19	—.03	94
V106 —Distance to College	—.26	.53*	.01	—.29	—.08	44
V192 —Village Literacy Rate	.34*	.03	—.91	.09	—.07	100
V193 Male Literacy Rate	.31*	.06	—.91	.03	.11	100
V194 —Female Literacy Rate	.39*	—.00	—.81	.01	—.33	99
V252 —Educational Level of Respondents	.87*	—.17	—.21	.07	—.33	94

(*contd.*)

TABLE B.4 (*Contd.*)

FACTORS ANALYSIS (VARIMAX) OF EDUCATION AND EDUCATION INSTITUTION VARIABLES

Variables	Factors Loadings					
	1 Education Level	2 Access to Educational Institutional	3 Village Literacy	4 Access to Madrasa	5 Village Women Education	Per cent Variance Explained
V253 —Education Level of R's Husbands	.92*	—.06	—.29	—.01	.17	96
V258 —Literacy Rate of R's	.81*	—.17	—.24	.03	—.35	87
V260 —Literacy Rate of R's Husbands	.79*	—.07	—.35	.10	.20	80
V262 —Education Level of R and Husband Combined	.94*	—.09	—.28	.02	—.02	98
Factor Contributions :						
To Total Variance in Per cent	32	15	21	4	3	75
To Explained Variance in Per cent	43	20	28	5	4	100

*Factor score coefficients (raw score form) of the starred variables in each factor were used in creating the index.

TABLE B.5

FACTOR ANALYSIS (VARIMAX) OF AGRICULTURE DEVELOPMENT VARIABLES

Variables	Factor Loadings and Descriptive Names of the Factors			
	1 Modern Agricultural Practices	2 Irrigation Facilities	3 Farmer's Organisation	Per cent Variance Explained
V 57 —TIP Group	.02	.23	—.51*	31
V 58 —Cooperative Society	—.02	—.53	—.34*	40
V 61 —Farmer's Cooperative	—.01	.05	—.51*	26
V 62 —Agriculture Worker's Visit	.04	.13	—.28*	10
V 66 —Deep Tubewell	.02	—.61*	—.14	38
V 69 —Shallow Tubewell	—.07	—.44*	—.10	21
V208 —% Families Using Chemical Fertilizers	.81*	—.07	.10	68
V210 —% Families Using New Seed Variety	.75*	.00	—.11	57
V211 —% Families Using Insecticides	.88*	—.03	.01	78
Factor Contributions :				
To Total Variance in Per cent	22	10	9	41
To Explained Variance in Per cent	54	24	22	100

*Factor score coefficients (raw score form) of the starred variables were used in creating the index.

TABLE B.6

FACTOR ANALYSIS (VARIMAX) OF THE HEALTH AND FAMILY PLANNING VARIABLES

Measures	Factor Loadings					
	1 Access to Thana-based Health and Family Planning Services Index	2 Health & Family Planning Workers Visit Index	3 Access to Local Family Planning Service Index	4 Distance to Other Doctor	5 Sanitation Facilities Index	Per cent Variance Explained
Tubewells for Drinking Water	—.02	—.38	—.10	—.01	—.59*	36
Sanitary Latrines	—.08	—.04	—.02	.61	—.35*	50
Distance to Dispensary	.30	—.07	—.31*	.11	—.10	25
Distance to Pharmacy	.35	.03	—.61*	—.05	—.01	50
Distance to Hospital	.62*	—.10	.17	—.08	.06	44
Distance to Health Clinic	.70*	—.13	—.00	.02	—.16	53
Distance to MCH Clinic	.54*	—.02	.48*	—.02	—.09	56
Distance to Family Planning Clinic	.81*	.02	.20	.07	—.03	70
Distance to Qualified Doctor	.57*	—.40	.42	.01	—.00	51
Distance to Nurse	.59*	.02	.23	—.16	.11	46
Distance to Dai	.15	.03	—.68*	—.59	—.23	48
Distance to Kabiraj	.13	—.08	—.38*	.05	—.06	18
Visit by Vaccination Team	.07	—.70*	—.09	—.01	—.04	51
Visit by Family Planning Team	—.01	—.74*	—.06	—.14	.04	58
Visit by Malaria Team	—.12	—.42*	.06	—.01	—.01	20
Distance to Thana Hdqrter.	.72*	.05	.31	.05	—.02	65
Factor Contributions :						
To Total Variance in Per cent	20	8	11	5	4	48
To Explained Variance in Per cent	42	17	23	10	8	100

*Factor score coefficients (raw score form) of the stared variables in each factor were used in creating the index.

Appendix C

TABLE C.1

FACTOR ANALYSIS (VARIMAX) OF THE DEPENDENT VARIABLES

Measures	Factor Loadings				
	1 Knowledge of Clinical Contraceptive Methods Index	2 Contraceptive Practice Index	3 Knowledge of Non-clinical Contraceptive Methods Index	4 Fertility Norms	Per cent Variance Explained
Want No More Children	—0.02	—0.42	—0.19	—0.15	28
Desired Family Size	—0.15	—0.08	—0.09	—0.49	29
Knows Pill	0.71*	—0.46	—0.30	0.16	62
Knows IUD	0.56*	—0.24	—0.43	—0.34	67
Knows Douche	0.64*	—0.06	—0.41	—0.14	62
Knows Condom	0.25	—0.37	—0.69*	0.02	67
Knows Rhythm	0.23	—0.27	—0.72*	—0.29	65
Knows Withdrawal	0.16	—0.16	—0.70*	—0.31	61
Knows Abstention	0.18	—0.27	—0.60*	—0.11	52
Knows Feminine Sterilization	0.77*	—0.13	—0.06	—0.30	74
Knows Male Sterilization	0.77*	—0.12	—0.16	—0.46	84
Ever Used Method	0.13	—0.91*	—0.27	—0.02	91
Currently Using Method	0.18	—0.78*	—0.20	—0.72	23
Intention to Use Contraceptive Methods in the Future	0.33	—0.30	—0.11	—0.05	
Factor Contributions :					
To Total Variance in Per cent	20	15	18	6	59
To Explained Variance in Per cent	34	25	31	10	100

*Factor score coefficient (raw score form) of the starred variables in each factor have been used to create index.

Appendix D

TABLE D.1

ZERO ORDER CORRELATIONS BETWEEN THE VILLAGE LEVEL PREDICTORS AND DEPENDENT VARIABLES

Predictors	Dependent Variables		
	Knowledge of Clinical Contraceptive Methods Index	Contraceptive Practice Index	Knowledge of Non-Clinical Contraceptive Methods Index
Modern Agri-input Index	—.01	.04	.06
Irrigation Facilities Index	.15	—.02	—.08
Farmers' Organization Index	.03	—.02	.09
Access to Educational Institutions Index	— .22**	—.06	—.21**
Proportion of Families Sending Children to School	.34***	.22**	.39***
Access to Means of Roadway Index	—.18*	—.15	—.15
Access to Waterways Index	—.19*	—.06	—.19*
Number of Radios Available	.20*	.02	—.09
Availability of Newspapers	.14	—.13	—.08
Employment Level Index	—.14	—.05	—.20*
Economic Condition Index	.09	—.12	—.09
Education Level Index	.42***	.28***	.35***
Access to Thana-based Health and Family Planning Services Index	—.18*	—.12	— .17*
Health and Family Planning Workers visit Index	.10	.28***	.13
Access to Local Health and Family Planning Services Index	.01	.04	.11
Sanitation Facilities Index	.05	—.05	—.00
Youth Club	.24**	.08	.07

*Significant at p $\leq$.05 level

**Significant at p $\leq$.01 level

***Significant at p $\leq$.001 level

Foodgrains Demand Elasticities of Rural Households in Bangladesh—An Analysis of Pooled Cross-Section Data

by

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This paper attempts to estimate the foodgrains demand elasticities of rural households in Bangladesh by using pooled cross-section data from several rounds of a family budget survey known in short as the QSCEC. The estimated elasticities are income-class-specific and are based on a demand-theoretic specification of the own-price, cross-price and income elasticities of consumer demand. The estimation of these elasticities can be useful in analysing the effects of changes in foodgrains prices on different economic groups and in devising a sound food policy. The statistical results are of particular interest for testing some standard hypotheses regarding consumers' behaviour at extremely low levels of living such as obtain in rural Bangladesh.

I. INTRODUCTION

The analysis of foodgrains demand of peasant households in Bangladesh is of crucial importance given the predominantly agricultural nature of the economy. The income and price elasticities of peasant households' demand for foodgrains determine in an important way the nature of the demand-supply balance in the foodgrains market—by far the most important segment of the Bangladesh economy. A sound food policy needs to be based on estimates of foodgrains demand elasticities that are income-strata-specific. From a demand-theoretic point of view, estimating these elasticities is of special significance for understanding the nature of consumers' demand at extremely low levels of living such as obtain in rural Bangladesh. It is often suggested that at such absolute levels of poverty, one would expect a high income elasticity of demand for staple foods along with a low degree of consumers' substitution.

Income-class-specific income elasticities of foodgrains demand are quite easy to derive by using data from cross-section consumption surveys. The same is not true of price elasticities, which are often difficult to estimate

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because of the problems of statistical methodology and scarcity of reliable data series, as is typical of many underdeveloped countries. Time-series data are sometimes used to estimate the price elasticity for the aggregate economy [1 ; 10] but, these estimates do not readily conform to the demand-theoretic notions of price elasticities.[1] The elasticity estimates reported in this study are based on pooled cross-section data from family-budget surveys carried out over a number of years. A per capita demand function has been fitted to the data on household income groups to yield elasticity estimates which are income-group-specific and which can be readily interpreted in terms of the 'theoretical' demand elasticities.[2] This is, however, not to claim any superiority of such estimates which will of course depend on the nature of the data and the quality of the statistical fit.

II. FOODGRAINS DEMAND FUNCTION

The foodgrains demand function of rural households, in per capita terms, can be written in the general form :

$$c = F\,(p_f, p_m, y) \qquad \dots (1)$$

where c is the per capita quantity of foodgrains consumption, p_f and p_m are the price indices of foodgrains and non-foodgrains respectively and y is per capita income including both cash income and the value of self-consumption of home-produced commodities. The elasticities of foodgrains demand with respect to p_f, p_m and y in this demand function are defined as the the own-price elasticity, α, the cross-price elasticity, β, and the income elasticity, γ, respectively. Assuming that demand is not affected by equal proportionate changes in all prices and money income (that is, the condition of homogeneity of degree zero is satisfied), the demand function can be expressed in terms of the relative price of foodgrains and income reckoned in foodgrains equivalent, so that

$$c = f\,(p_f/p_m,\ y/p_f) \qquad \dots (2)$$

It can be shown that the elasticity of foodgrains demand with respect to the income term in this demand function is the usual income elasticity

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[1]The difficulties of interpreting statistically estimated per capita demand elasticities for the aggregate economy in terms of the 'theoretical' elasticities of individual consumer's demand are well-known [5, pp. 1150-54]. The resemblances are even more remote in the case of foodgrains demand in a low income economy where money income distribution is likely to be significantly affected by changes in foodgrains prices.

[2]Alamgir and Berlage [2] use pooled cross-section data to estimate foodgrains demand functions for rural and urban households in Bangladesh. They do not however follow any demand-theoretic specification of the demand function so that their estimated elasticities are not comparable to ours.

(γ), but the elasticity with respect to the price term is the algebraic sum of the income elasticity and the own-price elasticity ($\alpha+\gamma$).[3] Since the homogeneity condition implies that $\alpha+\beta+\gamma=0$, the latter is also the negative of the cross-price elasticity (that is, $-\beta$).

Determining a particular functional form from the general specification of equation (2) above is a matter of judgement and empirical fit. Throughout this analysis, we have used a per capita demand function of the following form :

$$c = a + b \log y/p_f + d \; p_f/p_m \qquad \text{... (3)}$$

The form of the function has been so chosen as to allow the income elasticity to decline smoothly with the increase in foodgrains consumption.[4]

III. DATA AND METHODOLOGY

For estimating the foodgrains demand function of rural households, we have used data from the Quarterly Survey of Current Economic Conditions (QSCEC) conducted by the Central Statistical Office (of erstwhile Pakistan) for the years 1963/64, 1965 (January-June), 1966/67 and 1968/69.[5] The QSCEC data relate to the entire fiscal year (except for the half year

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[3]This can be shown readily in the case of a demand function of the constant elasticity type .

$$c = a \; p_f^{\alpha} \; p_m^{\beta} \; y^{\gamma}$$

Since $\alpha+\beta+\gamma = 0$, this can also be expressed in the form

$$c = a \, (p_f/p_m)^{\alpha+\gamma} (y/p_f)^{\gamma}$$

It may be noted that in the case of agricultural households deriving income from foodgrains production alone, the demand function reduces to

$$c = a \, (p_f/p_m)^{\alpha+\gamma} q^{\gamma}$$

where q is the quantity of foodgrains produced per capita. Thus the price elasticity of peasant households' self-consumption of foodgrains is not given by the own-price elasticity α alone—hence the possibility of the so-called 'perverse' reaction of the marketed surplus to price changes. For detailed algebraic formulations of the price elasticity of foodgrains marketed surplus, see Nowshervani [14], Behrman [3] and Mahmud [12, pp. 88-97].

[4]The elasticities with respect to the income term and the price term in this demand function are given by b/c and $d(p_f/p_m)/c$ respectively.

[5]The QSCEC data were collected for rural and urban areas separately by using a multiple-stage sampling technique ; we have used here data on rural households only. The number of rural households covered in the surveys varied from about 3,000 to 5,000 in a year.

in 1965) and the information was collected on a quarterly basis to average out seasonal variations. An important methodological drawback is that the grouping criterion in the QSCEC data is household income and not per capita income. The figures relating to household income groups had to be, therefore, brought on a per capita basis by using the average family size in each income group.

The following points may be noted about the estimation of the dependent and independent variables of the foodgrains demand equation from the QSCEC data. (The estimated variables are reported in Table A.1 in the Appendix.)

1. Per capita average monthly foodgrains consumption, c, is derived from the quantity-wise information of rice and wheat consumption by each household income group. The quantities of rice and wheat are lumped together, noting that wheat consumption by rural households, on the average, is only 5 to 8 per cent of the total quantity of foodgrains consumption in any year.

2. For y/p_f (that is, per capita monthly income reckoned in terms of foodgrains), we have used per capita total consumption expenditure deflated by the wholesale price index of rice with 1963/64 as the base.[6] The use of total consumption expenditure instead of income seems more appropriate because rural income in different years may be affected by transitory factors arising from fluctuations in crop harvests. It may be noted that a large part of rural households' consumption expenditure is on home-produced commodities. According to the QSCEC methodology, these are valued at the prevailing retail prices in the nearest rural market.[7] We have excluded the

[6]We have made the simplifying assumption that, over the survey years, the income-group-specific price of rice moved in the same proportion as the general rice price index. A comparison of the wholesale prices of coarse, medium and fine quality rice shows that this is a reasonable approximation [19]. It may be noted that the foodgrains price paid by different income groups would vary in cross-section data because of quality variations, but this should not concern us in estimating the quantity demand elasticities.

[7]Imputing money value to the self-consumption of home-produced goods and treating food-surplus and food-deficit farmers alike involve some error in the specification of the demand function. The effective budget line for food-surplus farmers is given by the farmers' selling price or the harvest price, while, for food-deficit households, it is the retail foodgrains price which is relevant for budget decisions. It can be thus shown that at the same level of total expenditure as estimated by the QSCEC method, food-surplus farmers would tend to consume more food than other rural households because of the difference in the effective price ratio in the budget decisions of the two groups. For a diagrammatic exposition of this, see Bergan's [4] Appendix on imputed farm income.

QSCEC estimates of house rents from total consumption expenditure since rural households live in self-owned dwellings and there is no rural market for rented houses.

3. The relative price of foodgrains, p_f/p_m, has been estimated by deflating the wholesale price index of rice by the non-foodgrains price index constructed for this purpose (see Table A.2 in the Appendix). Ideally, one would construct the non-foodgrains price index for each income group separately. This could be done by taking the weighted average of the commodity-specific price indices with weights proportional to the respective income groups' expenditure on different non-foodgrains commodities. As a first step, we selected two income groups (one from the low-middle and the other from the high-middle income range) and constructed two different sets of non-foodgrains price indices for the survey years. As can be seen from the Appendix table, the alternative price indices do not vary significantly. Accordingly, we have used the first set of indices for the first (lower) four income groups in each year and the second set for the remaining higher income groups. The expenditure weights have been estimated by identifying as many individual items as are permitted by the breakdown of the QSCEC data and the prices are those reported in the official series of wholesale price indices [9, pp. 314-21]. For some agricultural commodities of perishable nature (e.g., milk, fish), no reliable and meaningful price information is available for rural areas. For these items, we have used the prices implicit in the QSCEC data which report food items in both expenditure and quantity terms. The estimated relative price index of foodgrains shows enough variations over the survey years for statistical analysis of price elasticities.

IV. REGRESSION RESULTS

Using 29 observations of the household income groups from the pooled QSCEC data, we estimated the foodgrains demand equation (3).[8] The ordinary least-squares estimate is given by :[9]

$$c = \underset{(-7.117)}{-21.04} + \underset{(21.54)}{15.83} \log y/p_f + \underset{(3.348)}{.0379}\, p_f/p_m \quad \cdots \quad (4)$$

$$R^2 = .9495$$

[8]Extreme income groups on either side of the income scale in each year have been excluded since the group means represent very few household observations and are therefore subject to higher random disturbances. Statistically, this is a problem of heteroscedasticity in grouped data which can be best taken care of by weighting the group means by the number of observations in each group [6, pp. 143-44].

[9]The figures in parentheses below the coefficients are t-values.

As can be seen, the above regression fit is satisfactory on all counts. The correlation coefficient is very high and both the income and price co-efficient are significant at more than 99 per cent level. The price coefficient is positive implying that the own-price elasticity is smaller than the income elasticity in absolute magnitude. (This also means that the cross-price elasticity of foodgrains demand with respect to the non-foodgrains price is negative.) To see if this holds for both the lower and the higher income groups, we arranged the income groups in order of the income term, y/p_f, and ran two separate regressions—one for the top 15 groups and the other for the bottom 15 groups. The following regression estimates were obtained (figures in parentheses are t-ratios) :

Lower Income Groups

$$c = -28.01 + 18.14 \log y/p_f + .04136\, p_f/p_m \quad \ldots \quad (5)$$
$$(-5.212) \qquad (11.81) \qquad\qquad (2.458)$$
$$R^2 = .9222$$

Higher Income Groups

$$c = 12.78 + 13.40 \log y/p_f + .0333\, p_f/p_m \quad \ldots \quad (6)$$
$$(-7.012) \qquad (6.851) \qquad\qquad (2.345)$$
$$R^2 = .7964$$

In both the above cases, the income coefficient is significant at more than 99 per cent level and the price coefficient at more than 95 per cent level, although for the higher income groups, the fit is less satisfactory. A negative cross-price elasticity of foodgrains demand is again indicated by the positive sign of the price coefficient in either case.

From the estimated demand equation (4), as given by the regression fit for all income groups, we have estimated the income elasticity (γ), the cross-price elasticity (β or—($\alpha+\gamma$)) and the implied own-price elasticity (α) for selected income groups from the 1968/69 QSCEC data. The elasticity estimates are presented in Table I. The alternative estimates shown in parentheses are given by the separate regressions for the lower and higher income groups. Equation (5) is used for groups 2 and 3 and equation (6) for group 7 in the table. Also, the percentage of rural population belonging to each income group, according to its ordinal position on the income scale, is shown in the table. The last row gives the elasticities estimated at the mean rural consumption expenditure level of 1968/69 (that is, at the mean value of y/p_f for all rural households in the 1968/69 QSCEC). As can be

seen, the elasticity estimates given by any single regression fall in absolute value as income increases.[10] The overall regression underestimates the income elasticity (and also the price elasticities) for lower income groups and over-estimates it for higher income groups compared to the elasticity estimates given by the separate regressions. This is probably an indication that even a semi-log form of the demand equation cannot adequately take care of the fall in the income elasticity as income increases.

The income elasticity estimates shown in Table I are clearly on the higher side compared to most of the standard estimates reported in the literature. These results should be interpreted in the context of widespread poverty and a high incidence of undernutrition among the rural population in Bangladesh [12, pp. 234-47]. What may be noted in particular is the rather high income elasticity estimate (above .4) even for the top ten per cent of the rural population. A low degree of consumers' substitution between foodgrains and other consumer goods is indicated by the estimated

TABLE I

ESTIMATES OF INCOME ELASTICITY, OWN-PRICE AND CROSS-PRICE ELASTICITIES OF FOODGRAINS DEMAND OF RURAL HOUSEHOLDS (BY INCOME GROUPS) IN BANGLADESH

Ordinal Income Groups in the 1968/69 QSCEC (% of rural population from bottom)	Income Elasticity γ	Cross-price Elasticity β	Own-price Elasticity α
Group 2	.63	−.18	−.45
(bottom 0.7% to 22.4%)	(.74)	(−.20)	(−.54)
Group 3	.57	−.16	−.41
(bottom 22.4 % to 50.0%)	(.66)	(−.18)	(−.48)
Group 7	.48	−.14	−.34
(bottom 90.9% to 96.8%)	(.41)	(−.12)	(−.29)
Mean Rural Consumption Expenditure Level, 1968/69	.55	−.16	−.39

[10]This is, however, an implication of the specific form of the estimated demand function.

negative cross-price elasticity of foodgrains demand.[11] At higher income levels, foodgrains are considered very much a relative necessity so that one would not expect a high degree of substitution between foodgrains and other consumer goods [16, p. 356]. The consumption bundle of the very poor, on the other hand, is characterised by the dominance of a few essential items satisfying complementary subsistence needs. At such low living standards, the possibility of substitution in the consumption bundle is likely to be limited and none of the major consumption categories are likely to have income elasticities widely different from unity.[12] The above hypothesis seems to be borne out by our estimates of a high income elasticity and a relatively low own-price elasticity of foodgrains demand in the case of low income households.

IV. IMPLICATIONS

The above estimates of the foodgrains demand elasticities of rural households have important implications for the foodgrains demand-supply balance in the economy. The high income elasticity of foodgrains demand of rural households implies that significant proportion of any increase in foodgrains production will be retained by the agricultural sector itself, particularly in the case of a broad-based agricultural growth strategy. Viewed in another way, this would also mean that any immediate upliftment of rural living standards must be realised to a large extent in terms of an increase in the per capita consumption of foodgrains and food in general.

A low degree of substitution between foodgrains and other consumer goods implies that foodgrains shortages are potentially destabilising for the economy and may lead to serious price repercussions. The estimated elasticities of foodgrains demand can also be useful in analysing how the impact of higher foodgrains prices are borne by the different economic groups. Neither richer farmers who have surplus food and therefore benefit from higher relative food prices nor the urban higher income groups who have

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[11]A negative cross-price elasticity of foodgrains demand indicates that the income effect of a change in the non-foodgrains price index dominates over the substitution effect [6, pp. 222-23].

[12]For a theoretical proof of this in a two-commodity consumption model, see Tolley and Giesman [17]. Special substitutes, like alternative foodgrains satisfying the calorie needs of the poor, may still have highly price-responsive demand. In the case of Indonesia, Timmer [18] finds that the foodgrains consumption pattern of the bottom 30-40 per cent of the population is indeed highly sensitive to changes in the relative price of the two foodgrains—rice and cassava.

near-zero elasticities of foodgrains demand anyway[13] are likely to reduce their consumption of foodgrains significantly if at all under the impact of rising foodgrains prices. To a large extent, therefore, the impact of foodgrains shortages falls on the food-deficit low income rural households who earn most of their income from wages and non-agricultural self-employment [7, pp. 261-84]. This is also likely to be true of the urban poor consisting mainly of unorganised labour and the self-employed engaged in various petty service activities. Because of the complementarity of consumption items at low income levels, the foodgrains consumption of these groups is reduced (and the demand-supply balance in the foodgrains market is restored) not so much due to consumption substitution between foodgrains and, say, manufactured wage goods (caused by relative price changes) as because of the fall in their real incomes (caused by inflationary increases in foodgrains prices). Thus, a process of growth with lagging food supply and rising food prices is also likely to be characterised by slack demand conditions in the market for manufactured mass consumer goods.[14]

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Appendix

TABLE A.1

DEPENDENT AND INDEPENDENT VARIABLES IN THE FOODGRAINS DEMAND FUNCTION OF RURAL HOUSEHOLDS

Household Income Groups in the QSCEC	c	y/p_f	p_f/p_m
III-2	23.35	12.47	128.72
IV-2	22.75	13.83	118.01
III-3	27.46	15.21	128.72
I-2	27.17	15.62	100.00
IV-3	27.36	16.33	118.01
III-4	28.77	16.72	128.72
II-2	27.79	18.15	91.19
IV-4	28.94	18.15	118.01
III-5	30.94	18.48	130.75
I-3	29.74	18.75	100.00
IV-5	30.12	19.85	119.55
III-6	32.24	19.93	130.75
I-4	31.47	20.57	100.00
II-3	31.31	21.20	91.19
IV-6	31.52	21.22	119.55
III-7	33.65	21.78	130.75
IV-7	31.29	22.33	119.55
I-5	32.99	23.06	100.00
II-4	32.38	23.49	91.19
I-6	33.42	23.64	100.00
III-8	35.30	24.73	130.75
II-5	34.52	25.91	93.53
I-7	35.14	26.08	100.00
I-8	34.08	27.59	100.00
III-9	36.27	27.58	130.75
IV-8	35.09	27.68	119.55
I-9	35.91	28.84	100.00
II-6	34.91	28.91	93.53
II-7	35.80	29.81	93.53

Notes and Sources :

1. The variables are defined as follows : c is per capita monthly consumption of rice and wheat (in lbs.), y/p_f is the consumption expenditure (Taka/per capita/ monthly) deflated by foodgrains price index with 1963/64 as the base and p_f/p_m is the foodgrains price index deflated by the non-foodgrains price index with 1963/64 as the base.
2. The observations are arranged in order of the value of the income term and are identified by the survey year (I : 1963/64 ; II : 1965 ; III : 1966/67 ; and IV : 1968/69) and by the ordinal household income groups in the QSCEC tables (numbered as 1, 2, 3,......).
3. The QSCEC data on foodgrains consumption and total consumption expenditure are from the published (1963/64 survey) and unpublished statistical tables of the *Quarterly Survey of Current Economic Conditions*, prepared by the CSO, Govt. of Pakistan [8].

TABLE A.2

ESTIMATION OF THE RELATIVE FOODGRAINS PRICE INDEX IN THE FOODGRAINS DEMAND FUNCTION OF RURAL HOUSEHOLDS

Items	Weight in Non-foodgrains Expenditure (%)		Price Indices, 1959/60=100			
	(income group A)	(income group B)	1963/64	1964/65	1966/67	1968/69
Non-foodgrains	100.00	100.00				
Pulses	5.45	3.16	91.8	126.2	126.8	142.8
Edible Oils	8.66	6.00	87.0	135.5	155.4	121.9
Milk	3.75	5.86	100.0	102.4	114.8	121.4
Fish	15.82	10.75	100.0	142.9	126.1	131.4
Potatoes and Onions	2.85	1.89	89.3	151.4	119.7	155.1
Spices and Condiments	6.43	4.71	126.2	99.1	140.8	178.7
Gur and Sugar	2.72	3.23	140.6	190.3	167.8	264.3
Tobacco	5.18	5.70	116.1	122.5	134.4	126.9
Pan and Betelnut	4.21	4.63	257.6	251.1	418.0	368.0
Firewood	15.74	12.35	103.1	110.4	111.1	141.5
Textiles	15.83	17.10	95.4	94.0	104.0	111.2
Othar Manufactures	13.34	24.62	102.1	107.0	115.7	122.1
Non-foodgrains Weighted Price Index :						
Income Group A			109.1	124.4	136.4	145.0
Income Group B			109.6	121.8	134.9	143.8
Rice Price Index			92.1	95.7	148.2	144.4
Relative Rice Price Index (1963/64=100) :						
Income Group A			100.0	91.19	128.72	118.01
Income Group B			100.0	93.53	130.75	119.55

Notes :

1. The income groups A and B refer to the household income groups with monthly income from Taka 100 to Taka 149 and from Taka 250 to Taka 299 respectively in the 1966/67 QSCEC tables for rural households .
2. All price indices, except for milk and fish, are from Pakistan CSO's series of wholesale price indices with 1959/60 as the base ; Government of Pakistan [9, pp. 314-21]. The price indices for milk and fish (with 1963/64 as the base) have been estimated on the basis of the prices obtained from the expenditure and quantity data on the average consumption of rural households in the different rounds of the QSCEC.

Notes

A Method of Estimating Adult Mortality Trends from Widowhood and Death Distribution Data

by

SIMEEN MAHMUD*

I. INTRODUCTION

In most countries of the developing world a system of vital registration often does not exist, or where it does, it is usually inadequate to provide the information required to estimate the levels and trends of fertility and mortality on a national basis. In many of these countries the levels of fertility and mortality have been changing over the last several decades, so that it is often of interest to estimate not only the current levels but the past trends exhibited by the birth and the death rates as well. In the absence of any national system of recording vital events and faced with the difficulties of census and survey data, various indirect estimation techniques have been developed and have recently been used in several countries [1 ; 8 ; 9]. These techniques generally require data that are relatively easy to collect from such populations, usually during a census or a single sample survey.

While most of the indirect procedures for estimating mortality rates relate to childhood mortality [3 ; 4 ; 15] little attention has been paid to the estimation of adult mortality. Both the Widowhood [11] and the Orphanhood [5] methods of estimating adult mortality make the assumption of unchanging mortality levels over the period being considered. In most developing countries where these procedures are to be applied, there is often evidence of mortality decline over the last two or three decades [13 ; 14]. In spite of this, adult death rates continue to be quite high and the declining trend seems to have now disappeared.

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The improvements in death rates that have taken place in these countries have been attributed to government health programmes. The aim of such programmes has been to reduce death rates by trying to eliminate diseases like malaria, smallpox, etc. While the crude death rate has been significantly reduced in many parts of the world, there has been little or no change in infant and child death rates. Thus, most of the efforts have resulted in lower mortality and morbidity favouring the adult population. There is hence a need in the developing countries for determining, whether adult death rates have been declining and at what speed, and whether the declining trend of earlier decades have now evened out.

This paper is an attempt to find a procedure for estimating past trends in the rate of decline of adult mortality from data collected during a census or a single sample survey. It indirectly focuses on trends in adult death rates by looking at proportions not-widowed by age-groups and changes in these proportions caused by diminishing death rates. An equation has been developed which expresses the proportion not-widowed of the ever-married population in an age-group as a function of the current level of mortality in the population, a first marriage frequency distribution, and the past rate of mortality decline.

A change in the age-specific death rates taking place over a number of years would affect the proportion of survivors in different age-groups and hence the proportion of the ever-married population not-widowed during successive years. If mortality has been declining, i.e., death rates in the past were higher than they are at present, then it could be expected that the proportion not-widowed in any age group would be lower in the past than at present. Different rates of mortality decline in the past would result in different proportions not-widowed by age-group at present.

II. THE METHODOLOGY

Let us consider a population whose age structure conforms to the stable form, i.e., both the fertility and the mortality rates are constant. We assume that the probabilities of dying are the same for the married as well as the single population so that we may generalise from the mortality experience of the ever-married population. Only first marriages are considered in order to overcome the problems arising from remarriage in the population.

Then let

$n(a,t)$ = the number of women married t years ago who were aged 'a' at the time of their marriage.

From the assumption of a stable population form we may write

$$n(a,\ t) = Be^{-r(a+t)}\ l(a)\ g\ (a) \qquad \dots (1)$$

where B = number of births this year,

$l(a)$ = current life-table survivorship ratio for females from birth to age 'a',

$g(a)$ = first marriage frequency for females aged 'a',

r = natural rate of increase of the population per annum.

Hence, the number of survivors to the present of these women who are now aged $(a+t)$ years will be given by

$$n(a,\ t)\ \frac{l\ (a+t)}{l\ (a)} = Be^{-r\ (a+t)}\ l\ (a+t)\ g(a) \qquad \dots (2)$$

Integrating (2) over all ages at which female marriages take place gives the number of women married t years ago and who are now alive, which is

$$\int_{a_o}^{a_w} n(a,t)\ \frac{l(a+t)}{l(a)}\ da = Be^{-rt} \int_{a_o}^{a_w} e^{-ra}\ l(a+t)\ g(a)\ da$$

$$= w(t), \text{ say,}$$

where a_o and a_w are the earliest and latest ages at which females in the population marry.

We now make the further simplifying assumption that all men marry at the mean μ of their marriage schedule. This assumption is made as otherwise information on the joint frequency distribution of male and female marriages by age is required and such information is rarely available. This may not introduce too large an error since it has been observed that in most developing countries both the male and the female marriage distributions have low dispersions. Hence, those men who were married t years ago and are still alive today are now $(\mu+t)$ years old and their probability of surviving from marriage to the present is given by

$$\frac{l_m\ (\mu+t)}{l_m\ (\mu)}$$

where l_m denotes life-table survival ratios for men.

Therefore, the number of men now aged $(\mu+t)$ years who were married t years ago will be

$$\int_{a_o}^{a_w} n(a,\ t)\ \frac{l_m\ (\mu+t)}{l_m\ (\mu)}\ da \qquad \dots (3)$$

and the number of men now aged $(\mu+t)$ years who were married t years ago and are not now widowed will be

$$w(t) \frac{l_m(\mu+t)}{l_m(\mu)} \quad \cdots \quad (4)$$

Now integrating (3) and (4) over the ages $\mu+t = N$ to $\mu+t=N+5$ (i.e., $t=N-\mu$ to $t=N+5-\mu$) of the men and dividing (4) by (3) we have

$$\frac{\int_{N-\mu}^{N+5-\mu} e^{-rt} \frac{l_m(\mu+t)}{l_m(\mu)} \int_{a_o}^{a_w} e^{-ra} \, l(a+t) \, g(a) \, da \, dt}{\int_{N-\mu}^{N+5-\mu} e^{-rt} \frac{l_m(\mu+t)}{l_m(\mu)} \int_{a_o}^{a_w} e^{-ra} \, l(a) \, g(a) \, da \, dt} \quad \cdots \quad (5)$$

It may be noted that the numerator in the above expression is the number of men aged between N to (N+5) years who have been married once and are not widowed now, and the denominator is the number of all men aged between N to N+5 who have been married once. Thus, the equation (5) gives the expected proportion of men not-widowed in the age-group N to N+5 under the existing conditions.

For our purposes we now consider a quasi-stable population i.e., one in which fertility remains constant and the changes in mortality are such that the age-structure of the population is not affected appreciably. Under conditions of declining mortality the current life-table survivorship ratios or the l(a) values will be different from the l(a) values at an earlier date, any t years ago. Let us then denote

$l(a, t)$ = the probability of surviving from birth (a+t years ago) to age 'a' t years ago

$$= \frac{l(1,a+t)}{l(0,a+t)} \cdot \frac{l(2,a+t-1)}{l(1,a+t-1)} \cdots \frac{l(a,t+1)}{l(a-1,t+1)}$$

$$= \prod_{i=1}^{a} \frac{l(i,a+t-i+1)}{l(i-1,a+t-i+1)}$$

$$= p\,(o,a,a+t) \text{ say,}$$

and,

$l(a+t,o)$ = the probability of surviving from birth (a+t years ago) to age (a+t) years at present

$$= \prod_{i=1}^{a+t} \frac{l(i,a+t-i+1)}{l(i-1,a+t-i+1)}$$

$$= p\,(o,\, a+t,\, a+t).$$

Similarly for the men,

$\frac{l_m(\mu+t,o)}{l_m(\mu+t)}$ = the probability of surviving from age μ (t years ago) to age $\mu+t$ at present.

$$= \prod_{i=\mu+1}^{\mu+t} \frac{l_m(i, \mu+t-i+1)}{l_m(i-1, \mu+t-i+1)}$$

$$= p_m(\mu, \mu+t, \mu+t)$$

where p(x, y, z) represents the probability of surviving from age x to age y for those born z years ago. The subscript m denotes the same probabilities for the men. It may be shown that in general

$$p(x,y,z) = \frac{l(y,z-y)}{l(x,z-x)} \prod_{i=x-1}^{y} \frac{l(i,z-i+1)}{l(i,z-i)} \quad \dots (6)$$

These probabilities may be calculated from the current life-table survivorship ratios and is shown below to depend on the rate of mortality decline in the population.

Let the current life table survivorship ratios be denoted by l(a) (for a = 1,2,3, . . 100, say) and let the logits of these l(a) values be given by y(a), so that

$$y(a) = \text{logit } l(a) = \tfrac{1}{2} \log_e \frac{1-l(a)}{l(a)}$$

Therefore,

$$l(a) = \frac{1}{1+e^{2y(a)}}$$

is the current probability of survival from birth to age 'a'. If y*(a) denotes the logit of the standard survivorship ratio, then we may express the current life table as

$$y(a) = \alpha_o + \beta_o\, y^*(a)$$

where α_o and β_o are the present values of the parameters α and β ; α varies with the level of mortality in the population, and β varies with the age-pattern of mortality.

Assuming the most simple case of a linearly declining mortality level in which the pattern of mortality with age remains unchanged amounts to imposing a constant rate of decline per annum on α with β being fixed. Then, $\alpha_t = \alpha_o + \gamma_t$ where α_t is the value of α t years ago, γ being the rate of decline of .

Letting $l(a, t)$ denote the probability of surviving from birth to age 'a' t years ago, and $y(a, t)$ denote its logit,

$$\begin{aligned} y(a, t) = \text{logit } l(a,t) &= \alpha_t + \beta_o \, y^*(a) \\ &= (\alpha_o + \gamma t) + \beta_o \, y^*(a) \\ &= y(a) + \gamma t \end{aligned}$$

Hence,

$$\begin{aligned} l(a, t) &= \frac{1}{1 + e^{2y(a,t)}} \\ &= \frac{1}{1 + e^{2y(a)+t}} \end{aligned}$$

From the above, we may estimate the probability that a person born $(a+t)$ years ago will survive to the present either from birth or from some age 'a' under declining conditions of mortality.

Hence, under the assumption that the level of mortality has been declining linearly in the past so that the age-pattern of mortality has remained unaltered, we can derive from equation (5) the expected proportion of respondents not widowed in the age-group N to (N+5) as follows :

$$\frac{\int_{N-\mu_R}^{N+5-\mu_R} e^{-rt} \, p_R(\mu, \mu+t, \mu+t) \int_{a_{os}}^{a_{ws}} e^{-ra} g_s(a) \, p_s(o, a+t, a+t) \, da \, dt}{\int_{N-\mu_R}^{N+5-\mu_R} e^{-rt} \, p_R(\mu, \mu+t, \mu+t) \int_{a_{os}}^{a_{ws}} e^{-ra} \, g_s(a) \, p_s(o, a, a+t) \, da \, dt} \quad \ldots (7)$$

where the subscripts R and s refer to respondents and their spouses respectively, and

μ = the mean of the first marriage schedule

$g_s(a)$ = the first marriage frequency for spouses at age 'a'

a_{os}, a_{ws} = the earliest and the latest ages at which spouses marry

$p(x, y, z)$ = the probability of survival from age x to age y for those born z years ago.

If mortality has been changing over the past years survivorship among the spouses of respondents in the various age-groups will also have changed, but probably in diffrent magnitudes. Firstly, the changes in the proportions widowed in any age-group will depend on the rate of mortality decline in the past. A rapid fall in the level of mortality will be reflected in a significant fall in the proportions widowed over the years (or, conversely, a rise

in the proportions not-widowed). Secondly, even with an equal improvement in the death rates at all the adult ages, the changes in the proportions not widowed are expected to be different for the various age-groups of respondents. Younger respondents (of ages 20-30) have been married for relatively shorter durations and have, therefore, been exposed to the risk of widowhood for a shorter time period. Hence, in the younger ages the proportions not widowed in the case of declining mortality and in the case of unchanging mortality are not likely to be very different. On the other hand the older respondents have, on the average, been exposed to the risk of widowhood for a longer period and their spouses have been subject to considerably higher levels of mortality than existing at present. Thus, under conditions of declining mortality, the proportions not widowed in the older age-groups would probably be much lower than if mortality had remained unchanged at the present levels.

Thus, provided our assumptions hold, we may expect that the comparison of the expected proportions not widowed under different values of γ, the rate of mortality decline, with the proportions actually observed would provide some idea about the general trend of mortality change and give an indication about the most likely value, or a range of values of γ.

Estimation of Parameters

Estimation of the p (x, y, z) probabilities (see equation (5)) depends upon a set of current life table survivorship ratios or the l(a) values. These l(a) values may be calculated from a set of observed age-specific death rates that are more or less representative of the level of mortality in the population. The calculated l(a) values are then fitted to the standard life table by the logit expression $y(a) = \alpha_o + \beta_o y^*(a)$ in order to estimate the parameters α_o and β_o. A method of fitting which may be used is the Group Average Method given by Brass [2].

The expression for first marriage frequency which can be used is the one developed by McNeil [6] and is given by

$$g(a) = \frac{019465}{k} \exp\left[\frac{-0.174}{k} (a - a_o - 6.06\ k) \right. \\ \left. \exp\left\{ \frac{-0.2881}{k} (a - a_o - 6.06\ k) \right\} \right] \qquad \ldots (8)$$

Coale has found that first marriage frequencies conform to a curve of the same shape in different populations and differ only in the age at which first marriage begins, the duration of the age-span within which most of the marriages take place, and the proportion at advanced ages who have been married once [7]. g(a) gives the first marriage frequency at age 'a'

and depends upon the two parameters a_0, the age at which first marriage begins, and k, the number of years of nuptiality in the observed population that is equivalent to one year in the standard schedule. The mean of this frequency schedule is known to be $a_0 + 11.37$ k and has been called the Singulate Mean Age at Marriage or SMAM. Hajnal gives a simple method for its calculation from data on proportions single by standard age-groups [10]. Thus a_0 and SMAM fully detrmine the first marriage frequency distribution g(a). A model first marriage schedule can then be selected from the Coale-McNeil system by trying various combinations of a_0 and k that gave more or less the observed SMAM and then selecting that combination which seemed to fit closest the observed proportions ever-married. From (6) an approximation of the expected proportion ever-married at each age is obtained by multiplying G(a) by a constant equal to the ultimate proportion who will evermarry in the population, where

$$G(a) = \int_{a_0}^{a} g(x)\,dx$$

Fitting the first marriage schedule will give estimates of the parameters a_0 and k. For convenience in integration, a_0 may be rounded to the nearest whole number and a_w can be taken as $a_w = a_0 + 30$. The mean of the first marriage schedule μ can be estimated by the SMAM which is easily calculated.

III. PRELIMINARY APPLICATION

In order to determine whether the model developed gives consistent results, a preliminary investigation was made using data from the 1974 Bangladesh Retrospective Survey of Fertility and Mortality (BRSFM) which was conducted simultaneously with the post enumeration check of the 1974 Population Census of Bangladesh. Data used includes the population age-distribution, deaths in the household over the last two years and the proportions single, ever married and not-widowed by standard five-year age-intervals for both females and males. Although these data are subject to considerable errors (e.g., age-misreporting, selective under-enumeration and under-reporting of deaths, etc.) as reported in [9] they have been used since they were readily available in the form required.

The estimated parameters and the proportions not widowed by five-year age-groups are presented in Table I. A comparison of the observed and estimated proportions of females not-widowed are then presented in

Table II. The males have been excluded from the comparison as the observed proportions of males not widowed are likely to be more unreliable than the female figures due to relatively higher male remarriage rates especially at the older ages.

In Table II we notice that when mortality has remained constant, the estimated female proportions not widowed are higher than the observed proportions at all ages except ages 25-29 and the difference increases with age. A pattern may be noted in the observed values : for ages 25-40 the observed proportions agree closely with the estimated proportions for a two per cent fall in mortality ; for ages 40-50 the observed and estimated proportions agree quite well when the decline is four per cent per year, and for ages 50-60 the observed and estimated proportions seem to more or less agree for a ten per cent decline in mortality level. However, the observation for ages 60-64 is still lower than the corresponding estimate for $\gamma=0.10$. One reason for this may be that the observed proportion of women not-widowed aged 60-64 may be subject to greater errors as numbers are few and recall errors might creep in since these women were first married about 45-50 years ago.

Thus there does not seem to exist one particular value of γ for which the estimated proportions agree well with the observations at all the ages. Rather, different rates of mortality decline seem to be operating at different ages making it unlikely that mortality has remained constant over the years. One explanation of this pattern might be that our initial assumption of a uniformly declining mortality level over the lifetime of the respondents might not hold in the context of Bangladesh. Mortality decline in Bangladesh may have been very steep about 30-40 years from now after which it began to slow down although the level was still falling, and in the last decade the rate of fall of mortality was considerably slower. Such a pattern appears quite plausible, although the estimates of γ might not be very reliable. In fact census figures show that there was a tremendous improvement in female widowhood between 1931 and 1951, but not as great a change between 1951 and 1961, and the widely accepted view is that there has not been much improvement in mortality levels during the last decade.

Application of this technique to Bangladesh data is intended to be merely an exercise to find out what sort of results the method produces. It yet remains to be seen whether any results obtained are reasonable enough for definite conclusions to be drawn in situations where adequate and reliable data are unavailable. It is encouraging to note that inspite of considerable errors in the data, our findings appear plausible and do not contradict existing evidence.

TABLE I

ESTIMATED PROPORTIONS NOT WIDOWED BY FIVE-YEAR AGE-GROUPS

Rate of Natural Increse r = .0280

	α	β	a_o	k	SMAM
Males	—.1800	.6500	15.1000	.8500	24.7645
Females	—.1000	.6500	11.8000	.4200	16.5754

Age Group	Proportions not Widowed							
	$\gamma=0$		$\gamma=.01$		$\gamma=.02$		$\gamma=.03$	
	M	F	M	F	M	F	M	F
25-29	.9847	.9382	.9845	.9341	.9844	.9301	.9844	.9261
30-34	.9570	.9088	.9552	.9003	.9534	.8918	.9517	.8833
35-39	.9286	.8756	.9232	8612	.9177	.8469	.9124	.8327
40-44	.9004	.8361	.8898	.8147	.8790	.7937	.8684	.7735
45-49	.8709	.7876	.8537	.7583	.8362	.7303	8193	.7045
50-54	.8382	.7267	.8132	.6895	.7881	.6551	.7646	.6249
55-59	.8001	6501	.7664	.6059	.7333	.5669	.7037	.5346
60-64	.7541	.5551	.7111	.5065	.6703	.4659	.6359	.4343

Age Group	Proportions not Widowed							
	$\gamma=.04$		$\gamma=.05$		$\gamma=.06$		$\gamma=.07$	
	M	F	M	F	M	F	M	F
25-29	.9845	.9221	.9846	.9181	.9847	.9141	.9849	.9102
30-34	.9502	.8748	.9488	.8664	.9475	.8585	.9462	.8510
35-39	.9073	.8190	.9023	.8062	.8976	.7947	.8931	.7845
40-44	.8582	.7548	.8486	.7385	.8398	.7247	.8318	.7133
45-49	.8036	.6820	.7895	.6636	.7773	.6491	.7668	.6379
50-54	.7439	.6004	.7264	.5816	.7121	.5677	.7007	.5575
55-59	.6792	.5100	.6598	.4924	.6450	.4801	.6337	.4714
60-64	.6092	.4118	.5894	.3967	.5750	.3867	.5645	.3800

Age Group	Proportions not Widowed					
	$\gamma=.08$		$\gamma=.09$		$\gamma=.10$	
	M	F	M	F	M	F
25-29	.9851	.9064	.9853	.9028	.9855	.8994
30-34	.9450	.8441	.9439	.8379	.9428	.8323
35-39	.8889	.7758	.8850	.7683	.8814	.7620
40-44	.8247	.7041	.8184	.6966	.8129	.6906
45-49	.7581	.6292	.7508	.6225	.7447	.6173
50-54	.6916	.5500	.6844	.5443	.6787	.5401
55-59	.6251	.4653	.6185	.4609	.6134	.4577
60-64	.5567	.3755	.5509	.3724	.5464	.3703

TABLE II

COMPARISON OF OBSERVED AND ESTIMATED FEMALE PROPORTIONS NOT WIDOWED

Age Group	Proportions not Widowed		
	Observed	Estimated	
25-29	.941	.9301	
30-34	.895	.8918	$\gamma = .02$
35-39	.839	.8469	
40-44	.751	.7548	$\gamma = .04$
45-49	.677	.6820	
50-54	.545	.5401	
55-59	.439	.4577	$\gamma = .10$
60-64	.306	.3703	

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Tax Effort in Bangladesh : Some Empirical Observations

by

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The objective of this paper is to shed some light on some aspects of the tax system in Bangladesh mainly in terms of an analysis of its tax efforts. Section I gives a brief background highlighting the salient features of our tax regime. The analytical exercise is contained in Section II where tax efforts is evaluated on the basis of a regression analysis. The methodological framework draws heavily on the Lotz-Morss formulation of the problem [1] with certain modifications. As the post-liberation data are insufficient for a regression analysis, four years' data are taken from the pre-liberation period with a gap of two years in between due to non-availability of reliable GNP estimates for these years.

I. THE TAX REGIME

The tax system of Bangladesh incorporates a multiplicity of taxes. But the bulk of the tax revenue comes from four major heads, viz. customs duty, excise duty, sales tax and income tax which account for more than 90 per cent of the total tax revenue (Table I). The overall tax base is sufficiently broad but the burden of taxation is not evenly distributed between different sources. For instance, share of direct taxes in the tax revnuee is only around 16 per cent. This contrasts sharply with the experience in developed countries where more than 80 per cent of the tax revenue is collected as direct taxes. The tax ratio has been improving over time, though it is still

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*The author is a Research Officer in the Bangladesh Bank. The views expressed in the paper are his own and do not necessarily reflect those of the Bank or the Taxation Enquiry Commission where he had worked for some time. He is grateful to Mr. Abul Quasem, Research Officer, Bangladesh Bank who read an earlier version of the paper and offered suggestions for further improvement. He also expresses deep gratitude to Mr. K.M. Jamsheduzzaman, Research Officer, Bangladesh Bank for his constant inspiration and practical help.

TABLE I

TAX REVENUE DURING 1972/73 TO 1977/78

	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78R
	(Absolute Amount : Taka in Crores)					
Indirect Taxes :	156.25	258.96	428.45	661.57	623.44	812.60
Customs Duty	(69.74)	(118.70)	(151.68)	(349.64)	(282.62)	(395.00)
Excise Duty	(54.96)	(83.60)	(150.35)	(161.87)	(208.04)	(230.00)
Sales Tax	(21.39)	(43.40)	(61.88)	(119.69)	(123.00)	(177.00)
Direct Taxes :	17.25	38.98	86.09	142.97	126.61	150.58
Income and Corporation Tax	(13.89)	(33.08)	(67.58)	(124.61)*	(109.47)*	(124.95)*
Land Revenue	(2.54)	(5.50)	(8.72)	(16.62)	(16.77)	(25.00)
Total Tax Revenue	**173.50**	**297.94**	**514.54**	**804.54**	**750.05**	**963.18**
Growth Rate (%)	—	72.00	73.00	56.00	(—)7.00	28.00
	(Percentage Composition)					
Indirect Taxes :	90.00	87.00	83.00	82.00	83.00	84.00
Customs Duty	(40.19)	(39.84)	(29.48)	(43.46)	(37.68)	(41.01)
Excise Duty	(31.68)	(28.06)	(29.22)	(22.61)	(27.74)	(23.88)
Sales Tax	(12.33)	(14.57)	(12.03)	(14.89)	(16.40)	(18.38)
Direct Taxes :	10.00	13.00	17.00	18.00	17.00	16.00
Income and Corporation Tax	(8.01)	(11.10)	(13.13)	(15.49)	(14.59)	(12.97)
Land Revenue	(1.46)	(1.85)	(1.69)	(2.06)	(2.23)	(2.60)
Total Tax Revenue	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
GNP at Current Factor Cost (Ml. Tk.)	4320.30	6792.50	12305.30	10137.00	9962.10	11137.90p
Growth Rate (%)		57.00	81.00	(—)18.00	(—)2.00	12.00
Tax-GNP Ratio (%)	4.02	4.39	4.18	7.94	7.53	8.65
Per Capita Income (Tk.)	581.00	889.00	1574.00	1269.00	1218.00	1331.00
Per Capita Tax Burden (Tk.)	25.00	41.00	69.00	103.00	94.00	115.00
Per Capita Tax Burden as % of per Capita Income	4.30	4.61	4.38	8.12	7.72	8.64

Sources : For taxes—Ministry of Finance, Budget documents. For GNP and population—Bangladesh Bureau of Statistics, Monthly Statistical Bulletin.

*Including collection under Martial Law Regulation.

R = Revised

p = Provisional.

below most of the underdeveloped countries.[1] Per capita tax burden is also seen to have a rising trend.

Tax ratio as a measure of tax effort is a static measure which provides a view of tax performance in terms of degree of use of taxable capacity at a given time. In contrast, income elasticity of tax revenue is a dynamic measure of tax effort, indicating something about past efforts at increasing revenue. Table II presents a picture of the evolving pattern of income elasticity of revenue, with corresponding marginal tax rates.

TABLE II

MARGINAL TAX RATE AND INCOME ELASTICITY OF TAX REVENUE

Years	Marginal Tax Rate	Income Elasticity of Tax Revenue
1966/67	—	—
1967/68	0.09	1.74
1968/69	0.01	0.15
1969/70	0.09	1.80
1972/73	—	—
1973/74	0.05	1.25
1974/75	0.04	0.90
1975/76	—	—
1976/77	—	—
1977/78	0.18	2.33

Source : Appendix Tables A.1 and A.2.

To look more deeply into the tax structure, it is quite evident that the system of indirect taxation in Bangladesh is heavily dependent upon import trade. More than 50 per cent of our tax revenue is collected in the form of customs duty and sales tax on duty-paid value.

As shown in Figure 1, revenue from customs duty and, sales tax gradually rose over the years with the exception of a sharp fall in 1974/75 which was mainly caused by decreased imports. The rising trend is itself a consequence of rapid increase in the value of imports.[2] However, as this increased value of import was a composite result of world price hike and devaluation of Taka in 1975, the growth in import duty in real terms was substantially lower than the rate of growth in import trade (Table III).

[1]See Appendix Table A.3 for an inter country comparison.

[2]Nearly 40 per cent of sales tax is collected at customs point.

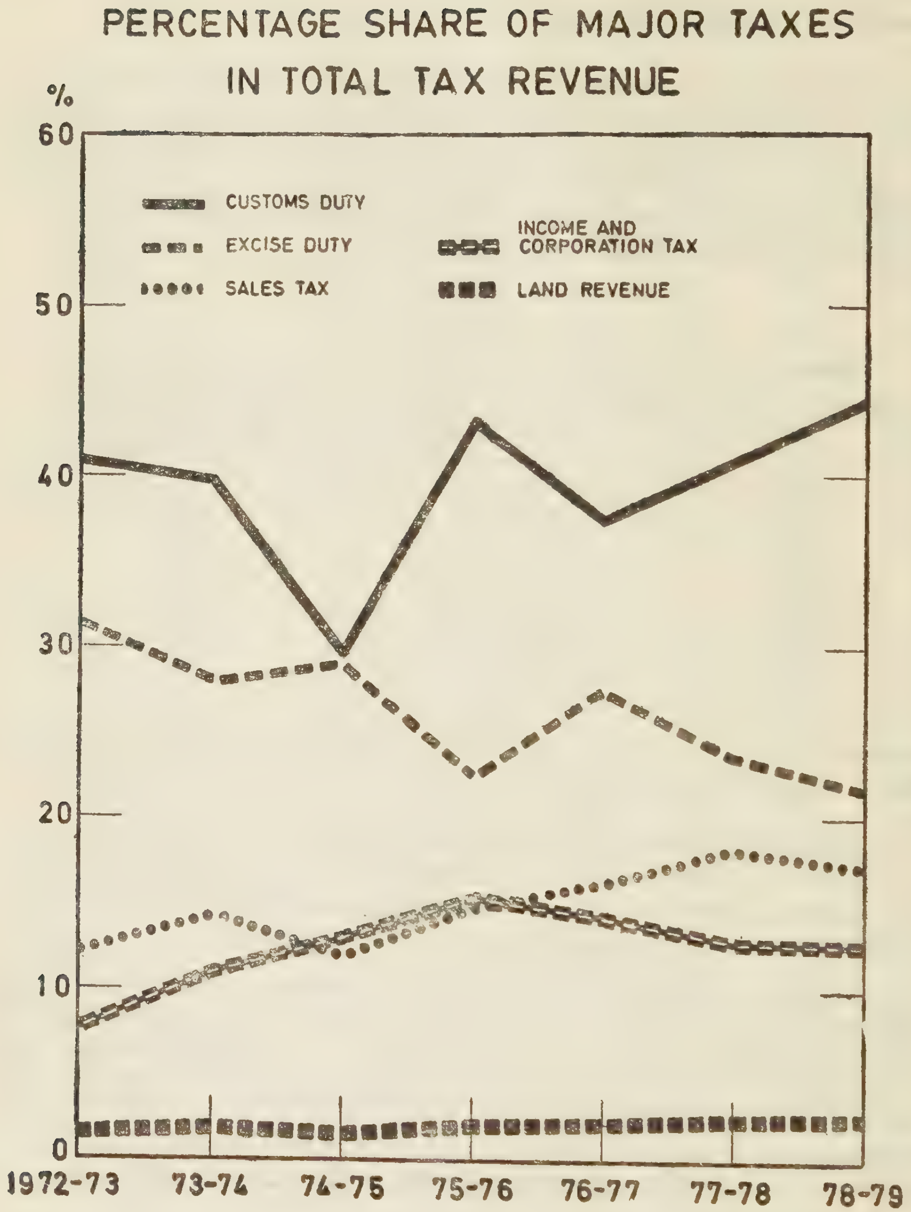
PERCENTAGE SHARE OF MAJOR TAXES
IN TOTAL TAX REVENUE
%
60
50
40
30
20
10
0
CUSTOMS DUTY
EXCISE DUTY
SALES TAX
INCOME AND
CORPORATION TAX
LAND REVENUE
1972-73
73-74
74-75
75-76
76-77
77-78
78-79

Figure 1

TABLE III

CUSTOMS DUTY IN MONETARY AND REAL TERMS

Years	Price Index[a]		Terms of Trade[a] $\frac{(3)}{(2)} \times 100$	Customs Duty in Monetary Terms (Crore Tk.)[b]	Customs Duty in Real Terms $\left(\frac{\text{Col. 5}}{\text{Col. 2}} \times 100\right)$
	Imports	Exports			
1	2	3	4	5	6
1972/73	100.0	100.0	100.0	69.74	69.74
1973/74	167.8	107.5	64.1	118.70	70.74
1974/75	245.4	134.5	54.8	151.68	61.81
1975/76	211.1	113.5	53.8	349.64	165.63
1976/77	218.0	116.6	53.5	282.62	129.64

Sources : (a) Planning Commission
(b) Table I.

Since customs revenue forms the major part of total tax revenue in Bangladesh, it meant that total tax revenue in real terms also did not grow rapidly enough (Table IV).

TABLE IV

TAX REVENUE IN BANGLADESH IN MONETARY AND REAL TERMS

Years	Wholesale Price Index[a]	Tax Revenue in Monetary Terms[b] (Crore Tk.)	Tax Revenue in Real Terms $\left(\frac{\text{Col. 3}}{\text{Col 2}} \times 100\right)$
1	2	3	4
1969/70	100.00	165.96	165.96
1972/73	240.49	173.50	72.14
1973/74	304.38	297.94	97 88
1974/75	454.27	514.54	113.27
1975/76	337.75	804.54	238.21
1976/77	315.80	750.05	237.51
1977/78	385.36	936.18	249.94

Sources : (a) 1979 Statistical Yearbook of Bangladesh, Bangladesh Bureau of Statistics.
(b) Table I.

II. TAX EFFORT MODEL

In this section we shall try to identify the factors which have significant bearing on the success or failure of tax effort in Bangladesh. This will be done through a regression analysis with the tax GNP ratio as the dependent variable. In keeping with the Lotz-Morss formulation of the problem [1], we identify two primary explanatory variables (i) per capita income, as an indicator of the level of development, and (ii) degree of openness of the economy, expressed in terms of ratio of the sum of imports and exports to GNP. As an additional "capacity" factor which presumably exerts a strong influence over the taxable capacity of the people and, through it, the tax ratio, we have also considered the composition of income, here measured as percentage shares of agriculture and industry in the GDP. Other factors considered are, the "administration" represented by the percentage share of direct demand on revenue in the total tax collection and, following a later study of Lotz-Morss [2], the degree of monetization expressed in terms of per capita supply of broad money.

The following linear equations are estimated incorporating the various explanatory variables :

(1) $T/Y = a_0 + a_1 Y_p$

(2) $T/Y = b_0 + b_i F/Y$

(3) $T/Y = c_0 + c_1 F/Y + c_2 Y_p$

(4) $T/Y = d_0 + d_1 F/Y + d_2 A_y$

(5) $T/Y = e_0 + e_1 F/Y + e_2 E_t$

(6) $T/Y = g_0 + g_1 F/Y + g_2 A_y + g_3 Y_p$

(7) $T/Y = h_0 + h_1 F/Y + h_2 E_t + h_3 Y_p$

(8) $T/Y = i_0 + i_1 F/Y + i_2 M_p + i_2 Y_p$

where, T/Y = tax-GNP ratio

F/Y = the ratio of imports plus exports to GNP, that is, openness of the economy

Y_p = per capita GNP

A_y = the share of agriculture in GDP

E_t = expenditure on tax collection as percentage of tax revenue

M_p = per capita supply of broad money.

Statistical Results

Multiple regression estimates of the specified equations on the basis of Single Equation Ordinary Least Square method are given below.[3] t-ratio is indicated within parentheses under each coefficient.

(1) $T/Y = 4.2190 + \underset{(1.7268)^{***}}{0.0019Y_p}$

$\bar{R}^2 = 0.1804 \quad S.E.E. = 1.5168$

(2) $T/Y = 1.6406 + \underset{(4.66)^{*}}{0.3039\ F/Y}$

$\bar{R}^2 = 0.6971 \quad S.E.E. = 0.9222$

(3) $T/Y = 1.6684 + \underset{(3.4280)^{*}}{0.3016\ F/Y} + \underset{(0.0044)^{****}}{0.0000039Y_p}$

$\bar{R}^2 = 0.6476 \quad S.E.E. = 0.9947$

$D.W. = 2.3753$ (N.A.C.)

(4) $T/Y = 14.1684 + \underset{(2.3939)^{**}}{0.1959\ F/Y} - \underset{(-1.8458)^{***}}{0.1946A_y}$

$\bar{R}^2 = 0.7675 \quad S.E.E. = 0.8079$

$D.W. = 3.2743$ (N.A.C.)

(5) $T/Y = 1.8564 + \underset{(3.181)^{*}}{0.1961F/Y} - \underset{(-0.1248)^{****}}{0.0238E_t}$

$\bar{R}^2 = 0.6546 \quad S.E.E. = 0.9847$

$D.W. = 1.9489$ (N.A.C.)

(6) $T/Y = 0.4632 + \underset{(1.7029)^{***}}{0.3324\ F/Y} + \underset{(0.6773)^{****}}{0.0264A_y} - \underset{(-0.382)^{****}}{0.008Y_p}$

$\bar{R}^2 = 0.8505 \quad S.E.E. = 2.4585$

$D.W = 1.8212$ (N.A.C.)

(7) $T/Y = 2.2673 + \underset{(2.8123)^{**}}{0.2965\ F/Y} - \underset{(-0.1946)^{****}}{0.0003Y_p} - \underset{(-0.1331)^{****}}{0.051E_t}$

---

[3]The values of the relevant variables and the sources are to be found in the Appendix Tables A.1. and A.2.

* Significant at 1% level at one-tail test.

** Significant at 5% level

*** Significant at 10% level

**** Insignificant.

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$$\bar{R}^2 = 0.5571 \quad \text{S.E.E.} = 1.115$$

$$\text{D.W.} = 1.9581 \quad \text{(N.A.C.)}$$

$$(8) \quad T/Y = 1.2092 + \underset{(1.5476)^{***}}{0.3688\, F/Y} - \underset{(-0.6125)^{****}}{0.003 Y_p} + \underset{(0.43)^{****}}{0.0152\, M_p}$$

$$\bar{R}^2 = 0.6992 \quad \text{S.E.E.} = 3.4875$$

$$\text{D.W.} = 2.7372 \text{ (N.A.C.)}$$

The finding that clearly emerges from the above analysis is that foreign trade-GNP ratio is the most important determinant of the tax ratio. This is also evident from Table V which indicates higher elasticity of this particular variable in all the specified equations.

TABLE V

ELASTICITIES OF EXPLANATORY VARIABLES

Equations	Variables				
	F/Y	Y_p	A_y	E_t	M_p
1)	—	0.2750	—	—	—
2)	0.7181	—	—	—	—
3)	0.7127	0.0006	—	—	—
4)	0.4630	—	(−) 1.8978	—	—
5)	0.6998	—	—	(−) 0.0198	—
6)	0.7854	(—) 0.1224	0.2574	—	—
7)	0.7007	(—) 0.0500	—	(—) 0.0400	—
8)	0.8714	(—) 0.4400	—	—	0.3600

Among the various models applied, the best result is attained under equation (6) where the degree of explained variance is 85 per cent. The equation incorporates foreign trade-GNP ratio, agriculture's share in GDP and per capita income as the independent variables. However, the foreign trade ratio in this model is statistically significant only at 10 per cent level of confidence, the other two factors being statistically insignificant with a negative sign for the co-efficient of per capita income. Equation (8) establishes a positive relationship of per capita money supply with tax ratio. Here also per capita income is negatively related to the tax ratio, and the foreign trade ratio is significant, at 10 per cent level.

*** Significant at 10% level

**** Insignificant.

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Appendix

TABLE A.1

DATA USED FOR REGRESSION ANALYSIS

(Figures in crores of Taka)

Years	GNP at Current Factor Cost	Total Tax Revenue	Import (c.i.f.)	Export (f.o.b.)	Population (million)	Direct Demand on Revenue	Money Supply (M_2—Broad Money)
1966/67	2550.3	126.95	156.7	157.5	66.5	11.26	426.56
1967/68	2718.3	141.52	132.8	148.4	68.4	9.70	450.80
1968/69	2874.2	142.77	194.3	154.3	70.4	8.27	475.23
1969/70	3133.6	165.96	181.3	167.0	72.4	8.79	518.86
1972/73	4320.3	173.50	208.2	50.4	74.3	10.80	989.11
1973/74	6792.5	297.94	732.0	298.3	76.4	11.93	1216.53
1974/75	12305.3	514.54	1084.2	313.6	78.2	13.63	1287.70
1975/76	10137.0	804.54	1470.3	555.2	79.9	15.63	1438.04
1976/77	9962.1	750.05	1399.3	667.0	81.8	18.06	1714.80
1977/78	11137.9	963.18	1294.0	750.0	83.7	26.55	2221.26
	(P.)	(R.E.)	(T.)	(T.)		(R.E.)	

Notes : (1) Figures for 1970/71 and 1971/72 are not available.
(2) Money supply refers to end-June position.
(3) P=provisional ; R.E.=revised estimates ; T=target.

Sources : (1) GNP and population figures for 1966/67 to 1969/70 are taken from C.S.O. Statistics as adjusted by Alamgir and Berlage in *Bangladesh : National Income and Expenditure 1949/50-1969/70* ; June 1974.
(2) Tax figures for 1972/73 to 1977/78 are taken from National Budget documents.
(3) Source of money supply is the Bangladesh Bank.
(4) Other figures are collected from different publications of the Bangladesh Bureau of Statistics and Ministry of Finance, Budget documents.

TABLE A.2

VARIABLES USED IN REGRESSION ANALYSIS

Years	Tax-GNP Ratio (T/Y)	Ratio of Foreign Trade to GNP (F/Y)	Per Capita GNP (Y_p)	Share of Agriculture in GNP (A_y)	Direct Demand on Revenue as % of Tax Revenue (E_t)	Per Capita Supply of Broad Money (M_p)
1966/67	4.98	12.32	384	58.98	8.87	64.14
1967/68	5.21	10.34	397	57.09	6.85	65.91
1968/69	4.97	12.14	408	54.66	5.79	67.50
1969/70	5.30	11.12	433	57.20	5.30	71.67
1972/73	4.02	5.99	581	59.40	5.89	133.12
1973/74	4.39	15.17	889	59.40	3.85	159.23
1974/75	4.18	11.36	1574	63.10	2.52	164.67
1975/76	7.94	19.98	1269	53.50	1.89	179.98
1976/77	7.53	20.74	1218	50.80	2.35	209.63
1977/78	8.65	18.35	1331	53.50	2.76	265.38

Notes : (1) Per capita estimates are in Taka while the ratios/shares are in per cent.

(2) This annexure is primarily based on Appendix Table A.1. The shares of agriculture iin GDP are taken from the Bangladesh Statistical Bulletin.

TABLE A.3

TAXES AS PERCENTAGE OF GDP IN SELECTED ASIAN COUNTRIES

Country/Years	1972	1973	1974	1975	1976	1977
Malaysia	17.6	17.4	20.5	21.0	20.4	22.5
Sri Lanka	19.6	19.4	18.4	17.4	17.7	—
Korea	12.3	11.7	13.4	15.1	16.3	—
Indonesia	8.7	8.2	8.5	13.3	13.7	—
Thailand	11.6	11.3	13.4	11.8	11.8	—
Burma	14.4	11.5	3.8	7.6	7.5	10.3
India	6.7	7.2	6.6	7.3	8.2	8.3
Pakistan	8.0	8.9	9.9	9.6	8.8	8.8
Bangladesh	—	4.3	4.4	4.4	6.5	7.2
Nepal	4.5	5.2	5.0	5.6	—	—
Afghanistan	3.5	3.5	4.0	5.7	5.3	—

Notes : (1) In computing the tax ratio only the central government tax figures were related to GDP (at market prices). Including the state and local taxes, tax ratio in India in 1966-68 was 11.6 per cent.

(2) Year generally indicates fiscal year. Wherever fiscal period is different from calendar year, the ending year of the fiscal year is regarded as calendar year.

Source : Asian Development Bank ; Key Indicators, April 1978.

Estimation of Potential Supply of Labour in a Rural Agrarian Economy*

by

BARKAT-E-KHUDA**

I. INTRODUCTION

Most studies attempting to measure the extent of underemployment in rural agrarian societies assume a potential supply of labour which is, more or less, arbitrary. For example, in most such studies a western norm of an eight-hour working day or a forty-hour working week or a 2000-2400 hours working year is used as the standard basis of estimating potential supply of labour (3 ; 7 ; 8 ; 11 ;). Although such a standard may be reasonable in most industrialized countries, and, perhaps, appropriate also in the formal sector in less developed countries, it would be arbitrary if one were to use it for labour force engaged primarily in agriculture and other household industries in the rural areas of leas developed countries. Work in agriculture and even in the informal sector of the urban economy is not organised rigidly around time standards. Therefore, the cut-off seems quite arbitrary. It is also better to have separate cut-off points for males, females and children aged 10-14 years. Howard noted, "In truth, the practical difficulties of applying anything that can be called an eight hour day in agriculture are so obvious that it becomes doubtful whether it is worthwile embarrasing public opinion with a discussion theoretically on the basis of the eight-hour day in agriculture', [9]. This is, according to Gadjil, "because the business of a family farm or of domestic industry does not require that punctuality in hours of work or regularity of attention and attendance which is required of a machine operator or attendant" [6]. Unless a more realistic estimate can be obtained for the potential supply of labour in rural agrarian societies, the measurement of the extent of under-employment would

*This paper is based on some of the materials contained in the unpublished Ph. D. dissertation of the author [12].

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tend to be biased either upward or downward, depending on whether the potential supply of labour is assumed to be low or high.

The key problem in this paper is the meaning to be put on the term "potentially available". An attempt is made in this paper to arrive at a realistic estimate of time potentially available for directly productive activities. Section II of the paper examines the methodology of estimation and Section III describes the sources of data and presents some estimates and their implications.

II. METHODOLOGY

In most rural agrarian societies people begin to work at quite an early age. However, for the present study we define active population to consist of all persons aged ten years and above.

In doing so, we deviate from the conventional definition of labour force, as we do not distinguish between students and non-students or between working women and housewives. But the conventional definition does not make much sense in the context of rural agrarian societies, especially in the case of women and children. We have observed elsewhere that the difference in the number of hours worked between working children aged 10-14 years and those of the same age enrolled in school was not very significant [12]. We have also noted there that among women aged fifteen years and above there was not much difference between those reported as "working" and those reported to be engaged in household work only.

Coming now to the problem of defining 'potential labour time' available for the active population, the first point to note is that we are concerned here with the time available for gainful employment, or directly productive activities (DPA) as we shall call it.[1] The usual income leisure analysis of labour supply is a misleading guide in this respect. The basic weakness of this analysis is the implicit assumption of a strictly dichotomous relationship between time spent in DPA and leisure, which implies that all time not spent on DPA yields leisure and the all time not spent in leisure is time spent on DPA. But in fact, there also exists a range of activities constituting neither DPA nor leisure and the failure to recognize this leads to an over-statement of the possibility of a negatively sloped supply-curve of labour. These activities include household maintenance activities, personal care and needs, social needs, studying and playing.

[1]Directly productive activities (DPA) refer to any time used for work that entitles a person to an earning (either in the form of cash or kind) as a result of being employed by someone else, time contributed to one's own or family farm or business as well as time contributed on an exchange basis (i.e., exchange labour).

The number of hours potentially available for DPA is estimated by deducting the minimum number of hours that have to be spent on such activities from the total number of hours available in an "effective working day".[2] The number of hours spent on activities such as household mainteance activities, etc. during the busy season represents the minimum number of hours persons belognging to different age-goroups and sex have to spend on such activities. Hence, it was decided that for the purpose of the present study the number of hours spent on such activities during busy season will be deducted from the number of hours constituting an "effective working day".

In order to estimate potentially available time for DPA over a year, it is also necessary to deduct the holidays from the total number of days in a year. But during the entire period of observation in a Bangladesh village[3] it was seen that on the whole the villagers did not participate in DPA only on two days-*Eid-ul-Fitr* and *Eid-ul-Azha* (these are Muslim festival days of great importance). Thus, we can say that the concept of "holiday" is virtually unknown to most villagers, who, when work is available, work all seven days of the week.

In addition to holidays, one also has to take into consideration the amount of time lost on account of rainfall and bad weather. Similarly, time lost on account of sickness should be deducted in estimating the potential supply of labour. The average number of hours lost daily on account of bad weather and illness is deducted from the total number of hours avilable, and this gives us a standard number of hours potentially available for the DPA for the entire period of observation.

Besides the various factors that limit the potential supply of labour in a human society, there is another important factor, i.e., the level of nutrition which determines the physical condition of the worker. Below a certain level of nutrition one cannot work and the potential supply of labour is zero. Fisk calls it the level of 'grinding poverty' [4 ; 5]. Above that level, the potential supply of labour increases as the supply of food increases, till a point is reached at which the level of nutrition is adequate to maintain the full physical capacity of a person. We found in our own survey that members less than one-third of all households in the village could provide two rice meals a day throughout the year preceding our investigation. This, perhaps, indicates that most people are below the level of nutrition that is adequate to maintain their full physical capacity. However, constrained by

[2]Here an "effective working day" refers to the time period between 5 - 30 A.M. and 7 - 30 P.M. (i.e., 14 hours, of the day). This is the most active part of the day during which people spend most of their productive time.

[3]Section III of the paper describes the period of observation.

the lack of sufficient data on calorie and protein intake, we had to assume away the effect of malnutrition on the supply of labour.

One final problem in deriving a standard estimate of mandays available for DPA is that the works of different age and sex groups are not of homogenous quality. Some studies have attempted to estimate some conversion coefficients to express all types of labour in terms of homogenous labour of a standard man-equivalent. These co-efficients have been derived mostly on the basis of the relative wage rate of men and women. But this is an intrinsically hazardous procedure. Different types of activities are involved in agriculture and related activities and these require different skills and capabilities and, hence, the respective wage rate must vary accordingly.[4] For example, ploughing involves expenditure of more energey on the part of males than weeding, fertilizing and even transplanting and harvesting. Similarly, among women husking involves greater expenditure of energy than boiling and drying grain and even threshing. The wage rates, therefore, vary according to the types of activities performed.

Because of these inherent problems in using wage rate as the criterion of calculating the value of the coefficient, and also in view of the fact that in rural agrarian societies most of the people work on their own or family farm or business and only a small proportion of the total work force is engaged in wage employment, no attempt has been made in the present study to calcultate the value of the coefficient and to convert the hour or day into standard man-equivalent. Instead, the number of hours and days potentially available for DPA has been estimated separately for sex and broad age-groups.

III. DATA AND ESTIMATES

In attempting to estimate the potential supply of labour, we used time-budget data collected daily over a period of seven months (from May, 1976 to December, 1976) for each person aged five years and above of a sample of thirty-four hunseholds in village Barkait in Comilla.[5] The method of data collection was based on observation supplemented by interviewing. For the purpose of the study a working day was defined as the 5-30 a.m. and 7-30 p.m., i.e., 14 hours of the day. Beyond 7-30 p.m. most of the time is spent on non-work activities, except during the very busy period.[6]

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[4]The problem is complicated further if in our analysis we consider household maintenance activities" within the purview of "work" [12].

[5]The total number of days observed was 210 days and the total population observed daily was 148 (71 males and 77 females) persons aged five years and above.

[6]A more detailed discussion on the methodology adopted in the collection of time-budget data is contained in [12].

Based on data source described above and using the methodology developed in Section II of the paper, an estimate of the number of hours potentially available for DPA by broad age-groups and sex is presented on Table I. The table shows celearly the differential by sex. Females, on average, are available for less than half the time for DPA compared to males. The differential is explained basically by the fact that females spend considerably more time on household maintenance activities than males and consequently have less time available for DPA, even during the busy seasons.

TABLE I

NUMBER OF HOURS POTENTIALLY AVAILABLE FOR DIRECTLY PRODUCTIVE ACTIVITIES BY BROAD AGE-GROUPS AND SEX

Allocation of Time	Males			Females		
	10—14 Yrs.	15—54 Yrs.	55 Years and Above	10—14 Yrs.	15—54 Yrs.	55 Years and above
1. Total Number or Hours Constituting an "Effective Working Day"	14.0	14.0	14.0	14.0	14.0	14.0
2. Time Spent on the Following Activities Daily During Busy Period :						
(a) Household Maintenance Activities	0.9	0.8	1.0	2.8	5.9	5.3
(b) Personal Care, and Needs	2.4	4.0	4.1	2.5	3.0	2.4
(c) Social Needs	0.4	1.1	0.9	0.3	1.1	2.4
(d) Studying	4.4	0	0	2.6	0	0
(e) Playing	1.6	0	0	1.5	0	0
Total	**9.7**	**5.9**	**6.0**	**9.7**	**10.0**	**10.1**
3. Time Lost Daily Through :						
(a) Sickness	0.3	0.4	0.6	0.2	0.3	0.6
(b) Rain & Bad Weather	0.2	0.3	0.3	0.2	0.2	.02
Total	**0.5**	**0.7**	**0.9**	**0.4**	**0.5**	**0.8**
4. Items 2+3	10.2	6.6	6.9	10.1	10.5	10.9
5. Number of Hours Potentially Available for Directly Productive Activities (Item 1-Item 4)						
(a) Daily	3.8	7.4	7.1	3.9	3.5	3.1
(b) Weekly	26.6	51.8	49.1	27.3	24.3	21.7
(c) Monthly	114.0	222.0	213.0	117.0	105.0	93.0
(d) Annually	1379.0	2686.0	2577.0	1416.7	1270.0	1125.0

Notes : 1. **Household Maintenance Activities** include such activities as food preparation and cooking, washing and cleaning, child care, marketing for household consumption, fetching water, collecting firewood and dry leaves, running errands, etc.

2. **Personal Care and Needs** includes activities relating to personal hygiene, eating, mid-day rest and praying.

3. **Social Needs** include activities such as visiting friends and relations (both within and outside the village), attending marriages, funerals, meetings, etc.

It is, thus, clear that they can be involved in DPA only for the time available to them after carrying out household maintenance activities. Any developement strategy for women must take this fact into consideration ; otherwise, their objectives may not be achieved.[7]

It can be seen from the table that the assumption of an eight-hour working day is not very relevant and meaningful in the context of rural agrarian societies. Thus, most estimates of underemployment made so far are likely to be biased upwards, especially in the case of women and children. Estimation of potential supply of labour ought to be made on the basis of factual data for the population under study rather than depending on western norm of a "working day".

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[7]This can have serious implications for the level of income and, hence, of welfare of those households which depend primarily on female labour (e.g., a female-headed household or a household where the only able bodied worker (s) is (are) a women).

A Missing Dimension of Food and Nutrition Policy in Bangladesh*

by

REZAUL KARIM

AND

F. JAMES LEVINSON**

I. THE PROBLEM DEFINED

It has become abundantly clear during the past decade that the long held notions of "closing the food gap", "creating self sufficiency in food grains", or "winning the race between food production and population growth" are relatively shallow concepts in seeking to combat malnutrition. The "food gap" concepts quite simply, are concerned with an adequate food supply to meet the "effective demand" of its population, i.e., enough to satisfy what the population can purchase. In countries where the gap between "effective demand" (what the people can buy) and "nutritional need" is large, increased food supply *per se* will not help. The example of India, with food grain stocks of 18 million tons in 1978 but some of the worst malnutrition in the world, is proof enough.

Increasing rice production in Bangladesh will, assuming large scale usage of high yielding varieties, increase rural employment to some extent. It has been estimated, however, that this higher per acre labour requirement of HYV cultivation has amounted to no more than 1·5 per cent per year. Even when one adds to this, additional employment from rice processing and marketing, and, perhaps in time, rural industries to support the

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agricultural sector, the total falls far short of the growing increase in the rural labour force which now stands at 2·4 per cent. This means a growing number of unemployed persons each year without the ability to purchase the rice which is produced. Eventually, this inadequate rural purchasing power will itself constitute a constraint to production (inadequate effective demand to support increased production) unless the government chooses to export the food which would represent a cruel irony in the face of such unprecedented malnutrition.

Increased rice production, coupled in the short run with continued food aid, will also have the effect of stabilizing prices. But the rural poor, constituting the bulk of the malnourished in Bangladesh, cannot afford adequate rice consumption even at existing stable prices. And there is little chance that rice prices would be permitted to fall substantially since this would create a local production disincentive.

Theoretically the Government has at its disposal a mechanism for providing essential food commodities to population groups which cannot afford an adequate diet at open market prices. This is the public food distribution or ration system which provides rationed food at roughly 33 per cent below open market prices. While such systems have had major nutritional and income distributional benefits in Sri Lanka [4] and Pakistan [5], they have not had such effects in Bangladesh. Excluding the 'food for work' category, fully 70 per cent of food distributed through the ration system goes to urban consumers and only 27 per cent of the poorest and most malnourished urban consumer families have access to the system. Even where small quantities of food are made available at subsidized prices to the rural poor, as many of 50 per cent of these persons cannot afford to purchase, the entire ration even with the subsidy.

All this leads some to suggest that in the absence of major structural change in the access to resources, including land, no policy or programmatic initiatives are likely to have a substantial effect on the socio-economic constraints to improved nutrition in rural Bangladesh.

While recognizing the possibility that this is true, the remainder of this paper looks at non-structural but, nonetheless, potentially important ways of having at least a marginal effect on these constraints through food and agricultural policy.

One highly important avenue pertains to explicit employment generation in rural areas. The most important type of rural employment for the

forseeable future will continue to be on-farm employment. Here critical issues relate to agricultural wage rates, the terms of sharecropping (how are input costs and yields shared) and the employment security of sharecroppers and agricultural labourers from season to season. Policies which affect these practices so as to benefit low income households will, almost certainly, have a far greater effect than any action taken on non-farm rural employment.

Yet the latter also is important. One recent study [3] indicates that in every district, employment created by existing food for work programmes does not even approach the saturation point in terms of the number of persons willing to work in off-season food for work projects at lower than argicultural wage rates. There also is potential for other types of rural employment specifically geared to low income families, where production of specific non-farm goods and services lags behind potential demand.

II. THE MISSING DIMENSION

We have discussed the fact that the poor and malnourished who lack effective demand are only marginally affected by an increase in the size of the pie, i.e., the production/availability of more food. We have argued that they are affected considerably by the means by which the pie is made, i.e., the employment generated and the patterns of production. We would also like to suggest here, and devote the remainder of this paper to the idea that the ingredients of the pie can make a substantial difference to low income malnourished households.

Traditionally when those of us in the nutrition community have thought of "ingredients" i.e., when we have thought of specific foods to be produced or consumed, we have judged them by their nutritional contents. How much protein does the food have ? What is its vitamin and mineral content ? These still are important. It appears, however, that other questions may be still more important. Some of these questions relate to relative prices of different commodities, income elasticity of their demand at different levels of income and costs of production.

A recent study in Indonesia looked at the relative nutritional contributions which would be made by rice, corn and cassava. In purely nutritional terms, particularly in terms of protein quality, rice would appear preferable to the other two. Yet the study indicated that the poorest 30% of the

population obtained about 40% of their calories from cassava and corn while the upper 3 deciles obtained only 14 per cent from these two crops. The bias with rice is just the opposite. Thus increasing cassava and corn production (despite their lower nutritional values) will provide disproportionate benefit to the diets of poor malnourished families while increased rice production will disproportionately benefit the economically advantaged [7]. A similar study in Colombia predicts that a 10 per cent increase in the supply of cassava would add 23 calories to the daily diets of the calorie-deficit population, while providing no additional calories to the adequately nourished population. In contrast, a 10 per cent increase in the supply of beef would add only 8 more calories to the daily diets of the calorie-deficit group, but would add 25 more calories to the diets of the adequately nourished group [6].

The lesson from this experience is that if we are genuinely interested in reducing socio-economic constraints of the malnourished population, it will be necessary to give special attention to those crops whose production will disproportionately benefit this group. This is the missing dimension of food policy we intend to stress in this paper.

In evaluating food crops from this broader nutrition/consumption perspective, the most important criteria would seem to be the price (can the poor afford to purchase adequate amounts of the food). The price is an important factor but not the sole factor determining the relative attractiveness of foods to lower and upper income groups. It is important to identify foods which are relatively more attractive to the poor than the rich, or which, in economic terms, have a high income elasticity of demand among the poor, but a low or negative elasticity of demand among the economically better off.

The third important element is cost of production of these crops. As we hope to indicate below, some of the crops which will disproportionately benefit the low income consumer, will also be attractive to the low income, mariginal producer. (Often, of course, they are the same person.) In order to benefit smaller producers, the crop must have low input cost requirements but high yield. And in order to create more employment, its cultivation should be relatively labour intensive.

As we look at the crops most likely to benefit the poorer, malnourished population groups, those which emerge as most attractive are the coarse grains—the millets (cheena and kaun), sorghum (jowar) and barley (jab) and sweet potatoes. Coarse grains are attractive in this respect since they can be produced easily and inexpensively on land not suited for rice and

wheat production, particularly on recently flooded saline soil. Irrigation is not necessary since the coarse grains are drought-resistant.

In the table below, sorghum, here as a representative coarse grain, and sweet potatoes are compared with irrigated and rain-fed rice and wheat in terms of the cost and returns of production. The table indicates the low production cost of sorghum, roughly half that needed for rice production, which makes sorghum particularly attractive to the marginal farmer. While sorghum production costs are somewhat higher than those for rain-fed wheat, the benefit cost ratio for sorghum is more than two times higher, in fact the highest of the crops considered. While employment generated appears low it is in fact much higher than if the land were used for grazing which is the alternative use of such land.

TABLE I

COMPARATIVE PER ACRE PRODUCTION DATA FOR RICE, WHEAT, SORGHUM AND SWEET POTATOES IN BANGLADESH

Crop	Yield (mds.)	Calories (000)	Production Cost (Tk.)	Revenue (Tk.)		Benefit Cost Ratio		Person Days of Employment
				To Owner	To Tenant	To Owner	To Tenant	
Rice (Irrigated Boro)[a]	35	452	1741	3996	1998	2.3:1	1.1:1	111
Rice (Rainfed local)[b]	25	323	1552	2783	1391	1.8:1	0.9:1	56
Wheat (Irrigated Sonalika)[c]	27	348	1439	2139	1069	1.5:1	0.7:1	77
Wheat (Rainfed local)[d]	12	155	765	1088	544	1.4:1	0.7:1	45
Sorghum[e]	35	455	829	2800	1400	3.4:1	1.7:1	37
Sweet Potatoes[e]	108	483	1817	2592	1296	1.4:1	0.7:1	52

a. Babuganj thana, Barisal ; source [1].
b. Itna thana, Mymensingh ; source [1].
c. Meherpur thana, Kushtia ; source [2].
d. Sujanagar thana, Pabna ; source [2].
e. Menoonite Central Committee studies in Noakhali and Comilla districts.

Coarse grains are equally attractive with respect to their consumption, since they have positive income elasticities of demand only among low income groups. Consumption among middle and upper income groups is negligible. In a study carried out in 1978 by the Ministry of Food and the Institute of Nutrition with assistance from USAID, sorghum consumption

was actually tested in 103 modified ration shops in Faridpur and Jessore Districts. The sorghum was sold at a price Tk. 50 per maund, half the price of subsidized rice and five eighths the price of subsidized wheat. The results indicated that sorghum offtakes were strongly biased toward the lowest income households. This was the case whether sorghum was sold as a substitute for wheat and rice or in addition to them. Of the poorest ration-shop-users, many of whom had been unable to afford their previous ration allotment, 63 per cent purchased sorghum thus increasing their calorie intake from the ration system by as much as 33 per cent for the same expenditutre.

Sweet potatoes are attractive as a crop for lands which currently remain fallow during the Rabi season. However, its primary value for low income rural households is that it lends itself so well to subsistence production on small amounts of land. Looking again at the table, sweet potato provides the highest caloric yield per acre (Sorghum is second). This means that even on a 5 decimal (one twentieth of an acre) homestead plot, a landless family of 5 persons can plant sweet potatoes between November and February and assure roughly 250 grams (half a pound) or 300 calories per person for half a year. At higher yields (the Mennonite Central Committee has found that yields of 200 mds./ acre are not unusual) the same family could meet almost a third of its average caloric intake from this tiny plot. The production cost, although high on a per acre basis, would amount to only Tk. 90 for the 5 decimal plot, and could be reduced considerably if the family grew its own cuttings, kept them during the rainy season and transplanted them in November.

Because of its low benefit-cost ratio, sweet potatoes are unlikely to be of interest to larger farmers who produce for the market. And given its low price (Tk. 24 per maund in Noakhali and Comilla) and negative income elasticity of demand among middle and upper income groups, its consumption, almost certainly, will continue to be limited to the poor.

Although we have not been discussing the nutrient composition of these foods *per se*, it should be noted that there are varieties of sweet potatoes particularly rich in Vitamin A which could target this nutrient to population groups who need it most.

III. IMPLICATIONS FOR GOVERNMENT POLICY

This means of assisting low income groups—through the promotion of foods, or indeed resources in general, which benefit them disproportionately—

constitutes a very different approach to the rural poverty problem than normally employed. The more conventional approach is to try and reach the poor with inputs—credit, fertilizer, health services, education—which are desired by upper income groups as well. Experience in Bangladesh proves time and again that in such cases, the targetting is rarely successful. When resources are scarce, the poor come last, regardless of the original intent of the development activity. The approach discussed here, by contrast, assures benefit to the poor precisely because upper income groups are not interested.

If the Government were interested in pursuing this approach—and there are indications of very real interest in the Ministry of Agriculture—the programmatic needs become fairly clear. In terms of agricultural production, there would be a basic need for some reorientation of existing agricultural activity toward these crops and their production by marginal farmers. This would include rapid multiplication of improved seed varieties by BARI for use in testing and demonstration programmes ; trials and demonstrations at BARI's 19 regional stations and sub-stations coupled with small scale trials in farmers' fields ; assistance by women extension workers to housewives for production on homesteads ; and possibly subsidized inputs of seed, at least for sweet potato-production, in the first year.

In terms of distribution, the sorghum study mentioned above indicated that inclusion of low priced coarse grains in the rural modified ration system is viable, manageable, and would be highly beneficial to low income, malnourished consumers who are unable to purchase an adequate diet in the open market.

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by

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This article first examines theoretically some of the Marxist and neo-Marxist arguments on the role of rural credit market and usury capital in perpetuating stagnation in backward agriculture. The data collected through surveys in two areas of Bangladesh also enable it to examine empirically some of the more recent models. It is argued in the article that the models provide only a partial analysis of the observed credit relations in Bangladesh agriculture. For a coherent and complete analysis, the totality of credit and land relations must be considered and the significant observation that a large part of loans in rural Bangladesh is provided free of interest must be put in proper perspective. The article provides an alternative analysis of rural credit relations and draws some implications for capital formation and capitalist growth in Bangladesh agriculture.

I. INTRODUCTION

In Marxist analyses, credit relations and usury capital in pre-capitalist agriculture are generally viewed as obstacles to innovation and the emergence of a capitalist mode of production. Two points are emphasised particularly : (a) moneylending brings in larger returns than investment on land and thus diverts capital away from productive channels,[1] and (b) usury helps to preserve a power structure where a few rural rich maintain dominant control over a large number of rural poor. The latter point focuses on the interrelationship between usury in credit relations and the contractual constraints imposed on tenancy and labour.[2]

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[1]See, for example, Sau [37].

[2]See the articles by Bhaduri [6 ; 7] ; Prasad [29].

This article examines these two constraints on capital formation and capitalist growth in the context of two areas in Bangladesh. The data used have been collected through surveys conducted personally by the author in 1975. The areas are Phulpur thana in Mymensingh district and Comilla-Kotwali thana in Comilla district. The number of farm households surveyed in the two thanas (henceforth referred to as Phulpur and Comilla) are 137 and 102. Phulpur represents a traditional agricultural area whereas Comilla represents a more progressive area in terms of agricultural practices, institutions, etc. The details of the survey methodology, area characteristics and the questionnaire have been already recorded in Rahman [31] and hence are not discussed here.

Section II of this paper provides a critical evaluation of relevant theoretical models ; Section III presents a detailed investigation of credit relations and their possible interlinkages with other 'markets' in the Survey areas ; Section IV examines the empirical validity of the models discussed in the first section ; Section V presents an alternative analysis of the observed credit relations and finally, the last section summarises the findings of the article.

II. USURY CAPITAL AND CREDIT RELATIONS : SOME THEORETICAL CONSIDERATIONS

In conventional neo-classical analyses rural credit markets in contemporary LDCs are viewed as markets facilitating production and consumption in a situation where producers and consumers are increasingly assuming separate identities. The emphasis is primarily on the non-institutional factors of the rural economy. For example, high rates of interest in rural credit markets are assumed to be due to the high premium on lenders' risk.[3]

In contrast to conventional analyses, a Marxist framework recognises the institutional factors and emphasises the role of usury capital and its links with the production relations in agriculture.[4] Earlier writings along this line viewed usury as the means used by moneylenders to appropriate

[3]One of the major neo-classical analysts of rural credit markets, Bottomley [8], regarded the increase in the supply price of capital, i.e., high rate of interest in the rural credit markets as arising due to high administration cost to the lenders. In another study (Bottomley [9]), lender's risk was used to explain the high rate of interest in rural credit markets. See also Bottomley [11 ; 12 ; 13] ; Wai [42] ; Adams *et al.* [1] ; Adams and Nehman [2].

[4]See the works of Kurup [18] ; Rao and Rao [33] ; Bhaduri [6 ; 7], among others.

the surplus produced by self-employed peasants and small scale producers. Marx [24, p. 596], for example, argued that usurer's capital in precapitalist agriculture "exerts, on the one hand, an undermining and destructive influence on ancient and feudal property. On the other hand, it undermines and ruins small-peasant and small burgher production, in short all forms in which the producer still appears as the owner of his means of production". He further argued that "Usury centralises money wealth where the means of production are dispersed. It does not alter the mode of production, but attaches itself to it like a parasite and makes it wretched. It sucks out its blood, enervates it and compels production to proceed under even more pitiable conditions" [24, p. 596]. For the specific conditions in Asia, he emphasised that "usury can continue for a long time, without producing anything more than economic decay and political corruption. Only where and when other pre-requisites of capitalist production are present does usury become one of the means assisting in establishment of the new mode of production by ruining the feudal lord and small scale producer, on the one hand, and centralising the conditions of labour into capital, on the other" [24, p. 597].

Kautsky [17] and later Lenin [22] also dealt with usury capital at considerable length in connection with capitalist development in agriculture. Lenin's view was that the development of merchant and usury capital in the countryside would retard the differentiation of the peasantry and thereby act as a brake on agrarian capitalism.[5]

The traditional role of usury capital in pre-capitalist economic formulations has been recently stressed by Bhaduri [6]. He formulated a model of landlord-tenant relationship to show how innovation and investment by tenants could be actively impeded by landlords. His model was developed in the context of West Bengal agriculture which he argued to be essentially semi-feudal[6] in character, and he based his model on the following assumptions : *kishans* (tenants) are heavily indebted to the *jotedars* (landlords) through previous consumption loans and are dependent on them for such loans ; (b) tenants

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[5]Lenin raised this point in his essay where he defended Kautsky against the criticism of Bulgakhov. See Lenin [22, Vol. IV, p. 183].

[6]According to Bhaduri [6], the basic features of semi-feudal production relations are as follows : (i) an extensive and non-legalised sharecropping system ; (ii) perpetual indebtedness of small peasants : (iii) the ruling class in rural areas operates as both landowners and lenders to small tenants ; and (iv) small tenants have incomplete access to rural 'markets' and are forcibly involved in 'involuntary exchange' because of peculiar organisation of such markets.

have no access to alternative markets ; (c) the landlord's share in the produce of rented-in land is institutionally fixed ; (d) the rate of interest on loans is exogenously determined ; and (e) landlords, and not tenants, are the decision-makers and the active agents of change. Landlords, therefore, enjoy two sources of income, one from share rental, the other from usury, and the latter is a function of the dependence of tenants on landlords for consumption loans. Bhaduri's argument is that investment and innovation on land will be obstructed by landlords so long as their gains through usury are greater than their potential gain in rent income from increased land productivity.[7]

Bhaduri's model is vulnerable on both theoretical and empirical grounds. Let us consider some theoretical criticisms. First, although Bhaduri's model assumed full control of tenants by landlords, his subsequent analysis did not recognise the full implications of this assumption. If landlords have sufficient power to impede innovation, then they ought also to have sufficient power to extract from the tenants[8] the extra profit generated through innovation. It can

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[7]Bhaduri's model thus provides an alternative explanation of the disincentive effects on tenants in a share-cropping system. For an appreciation of Bhaduri's model and the differences between this formulation and classical and neo-classical treatises on the disincentive effects of share-cropping and their broad implications, see Paine [28]. Classical writings had focussed on alternative tenurial arrangements and their impact on the incentive of tenants to invest in improvements on rented-in land. Thus Adam Smith [40, Vol. I, pp. 360-370], in the context of *metayer* system, and Marshall [23, p. 644], both discussed the disincentive effects generated by over-all tenurial insecurity. More recently, Sen [38] ; Sen and Verghese [39] ; Ladejinski [19] and Minhas and Srinivasan [25], among others, have reiterated the disincentive effects of share-cropping. For a discussion of some of these points, see Rahman [31].

However, two arguments and empirical observations reduce the operational significance of the classical and neo-classical 'discoveries' about the disincentive effects of share-cropping. First, the disincentive effect is diminished to the extent the share-cropping arrangement is complemented by cost-sharing ; and second, landlord's control over the decision-making of tenants means that the tenants may not have any choice, except in the supply of labour, about the application of inputs. See Saith [36] for a discussion on these points. Imperfections in various markets, especially in credit, and the absolute poverty of tenants were, therefore, advanced as parallel arguments for low levels of innovation and investment by tenants. Bhaduri's model developed one such theme and presented it as an alternative explanation of continuing stagnation in a backward agriculture. See also studies by Rao, C.H.H. [32] and Kurup [18].

[8]Arguments in similar line have been advanced by Griffin [15] ; Newbery [27] ; Ghose and Saith [14] and Saith [36]. See also Bardhan [4].

be logically argued that usury as a mode of appropriation of the surplus is unnecessary in a labour surplus economy because the bargaining power of tenants is extremely weak and share-cropping arrangements would reflect this weakness. The landlords could leave to tenants only that amount of the product which is just sufficient for their bare subsistence. Ghose and Saith [14, p. 306] have argued that "In such a situation, where the entire surplus product is extracted in the form of land rent, no such residual surplus product remains with the tenant that can be extracted in any other form". Second, implicit in Bhaduri's model is the assumption of an initial 'irregular debt' of the tenant. He did not analyse either the nature or the cause of this initial irregular debt nor did he bring out the full implications of this assumption.[9] If the initial debt is very high (in relation to the flow-repayment capacities) or if it is assumed that a sufficient time period has elapsed without any repayment, then it might become possible for the landlords to allow innovation without fear of suffering losses of usury income or control. This is simply because the tenant's debt service liability would be much greater than the extra income the tenant could hope for through innovation. Thus, instead of perpetuating stagnation landlords can simply postpone innovation and investment until such a condition is satisfied.[10]

The role of rural credit markets and usury capital in transferring surplus from tenants to creditors has also been emphasised by Bhaduri in a more recent article (Bhaduri [7]). In this study, he forwarded a model to explain the existence of high rates of interest in the unorganised money markets in backward agriculture. He criticised the conventional argument that high rates of interest in unorganised rural credit markets are due to the high premium on lender's risk. Under the assumptions of mutually independent organised and unorganised rural credit markets, non-marketability of collaterals offered by debtors and the personalised nature of credit relations, he argued that lender's risk in such markets is an irrelevant concept because it is advantageous for lenders to encourage default. By doing so they appropriate the collaterals. If the burden of repayment of principal plus interest exceeds the personal value which a borrower places on the assets pledged as security, it becomes rational for the borrowers to default as well. Lenders push up the interest rates so high that

[9]For an excellent discussion of the historical causes of 'irregular debts' in the context of specific areas in India and its implications, see Saith [36].

[10]For an algebraic proof of this point, see Ghose and Saith [14].

repayment of principal plus interest exceeds the value of collaterals. With lenders' risk reduced to an irrelevant concept, usurious extraction can be seen to form the very basis of interest rates in unorganised money markets.

The two models advanced by Bhaduri, however, are not mutually consistent. While in his earlier model, the rate of interest was treated as an exogeneous variable, the later model treated it as a control variable.[11] If landlords as creditors can control this variable for usurious extraction, they need not fear that tenants would be made 'free' through innovation and investment. They can always regulate the interest rate in such a way as to make the tenants perpetually indebted.[12]

In the rest of this article, credit relations in the Survey areas are examined in detail in order to test the empirical validity of Bhaduri's models and to identify some of their weaknesses. An alternative explanation of observed rural credit behaviour in the Survey areas is also put forward. Some of the important empirical questions posed are : (a) to what extent do landlords have significant credit relations with their tenants ? (b) is usury income a significant part of the landlord's total income ? (c) is the share-rental fixed ? (d) do tenants mostly take consumption loans from the landlords and if so, do these have high rates of interest ? (e) do tenants have any independent decision-making power as regards the choice of inputs, investment, etc. ? (f) how far are the incurred loans secured ? (g) is the transfer of collateral a significant phenomenon in the credit relations in such an agriculture ?

Given the vast domain of the debate, some justification of this special focus is necessary. First, Bhaduri's models are the most recent contributions to the debate ; they are also widely cited and several claims of

[11]Although it is not our purpose to elaborate this point of mutual inconsistency between the two models, it is mentioned here in passing because of the prominence of these models in recent debates on rural credit relations in backward agriculture.

[12]The role attached by Bhaduri to usury capital in his 1977 model is akin to what Prasad [29] called the 'reactionary role' of usurer's capital. Prasad argued that "The big landowning class, however, does not insist on full payment even in the long run. It often forces the debtors to sell their assets (mostly land) but rarely for complete discharge of the debt obligation" [29, p. 1305]. Unfortunately, Bhaduri did not provide any empirical support for his model and Prasad's data amounts to highly inadmissible evidence. For a criticism of the two models, see Rudra [34].

generality have been made on their behalf.[13] Second, these provide a formal integrated analysis of the landowner's and creditor's monopoly power in interlocking land, product and credit markets. Moreover, some political-behaviour postulates are introduced to explain the continuing stagnation of a backward agriculture. These, therefore, represent distinct methodological positions.[14] Third, the implications of the models are far reaching in the sense that such an agriculture is incapable of social and technological transformation through exogenous stimuli. The transformation of agriculture, therefore, must come from within, through a breakup of the stranglehold of the landlord on the tenant.

III. SOME ASPECTS OF THE CREDIT MARKET AND CREDIT RELATIONS IN THE SURVEY AREAS

This section describes some features of the credit market in the Survey areas and examines the credit relations and their interlinkages among various groups of farm households. The farm households (sometimes referred to as farms only) covered in the surveys have been first classified into owners and owner-tenants. The latter category henceforth is referred to as tenants and includes only a few pure tenant farm households. Owner farms have been again classified into three groups : small (whose owned land does not exceed 2.5 acres) ; medium (whose owned land is equal to or more than 2.5 acres but less than 7.5 acres) ; and large (whose owned land is equal to or more than 7.5 acres). The tenant farms on the other hand have been classified into Group I and Group II. Group I tenants own less than half of their cultivated land and Group II tenants own half or more of their cultivated land.[15]

It should be mentioned here that due to the classification of farm households into different groups, the number of farm households in some of the groups are quite small. For the sake of analysis, we have often proceeded to calculate proportions and percentages on the basis of those small numbers. Since the margin of bias or error in the proportion and percentages may be quite large, these figures and analysis based on them should be treated with care.

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[13]Claims of generality have come from Prasad [29] and Chandra [13]. See also Paine [23]. For an extension of Bhaduri's model [6] through the introduction of the risk factor, see Mukherji [26].

[14]See, for example, Paine [28].

[15]The problems in and the justification for using this classification have been spelled out in Chapter II of Rahman [31]. Hence, we are not presenting any justification here nor are we discussing the problems associated with them.

Sources of Finance and the Magnitude of Borrowing

Table I presents information on the number and percentages of borrowing households by size group for both Phulpur and Comilla. The table shows that about half the households in both the areas negotiated some form of loan during the year preceding the survey, i.e., during 1974/75.[16] About one quarter of the households obtained loans from organised sources. The percentage of households obtaining loans from organised sources increased with increasing size of farm households.[17] For example, in Comilla only about 12 per cent of small owner-farmers obtained loans from institutional (IN) sources and this percentage increased to 75 for the large owner-farmers. A similar trend can be observed in Phulpur as well. On the other hand, about 43 and 33 per cent of households in Phulpur and Comilla respectively obtained loans from non-institutional (NIN) sources.[18] Unlike loans from IN sources, the percentage of farm households negotiating loans with NIN sources decreased with increasing farm size. In Phulpur, for example, it fell from about 40 per cent for the small owner-farmers to about 18 per cent for large owner-farmers.[19] A larger percentage of owner-farmers in Phulpur obtained loans from IN sources than tenant-

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[16]These figures may be compared with figures at the all Bangladesh level. The Dacca University Socio-Economic Survey Board [44] found that about 68% households obtained some form of loan in the year preceding the survey. In 1967, a survey report by the Registrar of Co-operative Societies found the percentage to be about 46. See *Agricultural Credit in East Pakistan : A Survey Report* [43].

[17]The 1960 *Census of Agriculture* also found that about 13 per cent of households in 1960 had debt obligations to organised sources of credit. This is lower than our figures and probably shows the increase in borrowing from organised sources since 1960.

[18]The 1960 *Census* [45] reported that about 46% of farm households had debt obligation to the NIN sources. From this figure, it is difficult to infer anything definitely about the percentage of borrowing households (i. e., those households negotiating some loans during the preceding year) except probably that their percentage would be lower than the reported figure. If we assume roughly that the percentage of borrowing households would be about 10 percentage points lower than the percentage of indebted households, then the *Census* figure seems to tally reasonably well with our figures.

[19]The trend, however, is not that clear in the case of Comilla households. The percentage declined from 32.8 for small owner farmers to 12.5 for middle owner farmers. It then increased to 25 for large owner farmers However, we must admit that it is difficult to say something about the trend in Comilla as the number of observations in the latter two categories is quite small.

TABLE I

NUMBER AND PERCENTAGES OF BORROWING FARM HOUSEHOLDS : PHULPUR, COMILLA, 1974/75

	Owner	Small	Medium	Large	Tenant	Group I	Group II	All Farms
Phulpur								
1) No. of Borrowing Farms	41	18	15	8	32	13	19	73
2) Percentage of all Farms in each Category	45.1	42.0	40.5	72.7	69.6	68.4	70.4	53.0
3) Number of Farms Borrowing from IN Sources	20	6	8	6	8	4	4	28
4) Percentage of all Farms in each Category	22.0	14.0	21.6	54.5	17.4	21.1	14.8	20.4
5) Number of Farms Borrowing from NIN Sources	31	17	12	2	28	10	18	59
6) Percentage of all Farms in each Category	34.1	39.5	32.4	18.1	60.9	62.6	66.7	43.1
Comilla								
1) No. of Borrowing Farms	35	22	9	4	16	4	12	51
2) Percentage of all Farms in each Category	43.2	36.1	56.3	100.0	76.2	80.0	75.0	50.0
3) Number of Farms Borrowing from IN Sources	19	7	9	3	7	2	5	26
4) Percentage of all Farms in each Category	23.6	11.5	56.3	75.0	33.3	40.0	31.3	25.5
5) Number of Farms Borrowing from NIN Sources	23	20	2	1	11	2	9	34
6) Percentage of all Farms in each Category	28.4	32.8	12.5	25.0	52.4	40.0	56.3	33·3

Notes : IN : institutional and NIN : non-institutional.

Rows (3) and (5) or (4) and (6) add up to more than the figures in rows (1) or (2) because farm households may borrow from both the IN and NIN sources simultaneously and hence, may be included in both. For the definition of different farm groups, see the text,

farmers. Loans from NIN sources, however, showed the opposite pattern. In Comilla, a larger percentage of tenant farmers obtained loans from both IN and NIN sources.[20]

Table II shows the average amount of borrowing per household from both the IN and NIN sources. Average borrowings were found to be taka 546 in Phulpur and taka 555 in Comilla,[21] and for both areas, there was an observable tendency for average borrowing to increase with farm size. It was also higher for owner-farmers than for tenants. In Comilla, for example, small owner-farmers borrowed on an average taka 430 compared to the average borrowing of taka 1,000 by large owner-farmers. This finding is rather surprising. However, it can be seen from the next table that the higher borrowing by larger farmers is due to their greater access to organised sources of credit.

Tables III and IV present information on the percentage distribution of loans obtained from different sources. Table III shows that in both areas the largest source of NIN credit is 'friends and relatives'. They provided about 40 and 50 per cent of all NIN loans in Phulpur and Comilla respectively. The second largest source is the 'professional moneylenders' and this source supplied about 26 and 28 per cent of all NIN loans in the two areas. Landlords supplied about 11 and 8 per cent of NIN credit in Phulpur and Comilla respectively. Small owner-farmers and Group II tenants obtained larger percentages of NIN credit from professional moneylenders than did other groups.[22]

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[20] It is difficult for us to assign any reason for this finding. Probably, tenant farmers in Comilla are not that much restricted in negotiating loans both from the IN and NIN sources. This may be due to the fact that Comilla is a more progressive area and hence Bhaduri type restrictions are not that much applicable on them.

[21] Average credit per borrowing household as reported in different surveys and studies are presented below for comparison with our figures: 1956 *University Socio-Economic Survey Board* (taka 181); 1967 *Survey Report by the Registrar of Co-operative Societies* (taka 201); 1969/70 *BIDS Surveys* of Phulpur and Thakurgaon, obtained from Asaduzzaman and Hossain [3] (taka 337 in Phulpur and taka 439 in Thakurgaon). The increase over time of credit per households shows the increasing credit requirement of rural households. This may be partly due to the increase in prices and partly due to increase in working capital requirements.

[22] The only exception is the medium owner-farmers in Comilla. They obtained about 50% of their NIN loans from 'professional moneylenders'. In 1956, friends

(*Contd.*)

Among the IN sources, the largest percentage was supplied by the co-operatives. The Agricultural Development Bank (ADB) was next in importance.[23] (The co-operatives supply mostly short and medium-term loans whereas the ADB is a source for longer term loans.) It can be seen from the table that the importance of ADB loans increased with increasing size of farms. For example, in Phulpur, the ADB did not advance any credit to small owner-farmers or tenants whereas the large owner-farmers obtained about 61 per cent of their IN credit from this source. This tends to underline the fact that smaller and poorer farmers can offer very little as acceptable security to IN sources, especially to the ADB.[24] Moreover, the administrative problems and the bureaucracy in obtaining IN credit effectively keeps away the relatively less literate smaller farmers. Whatever the reason may be, the table shows quite clearly that small farmers have less access to IN sources of credit, especially from ADB. For example, in Phulpur, IN sources supplied about 31 per cent of total loans of small owner-farmers and only 11 per cent of that of tenant farmers. In contrast, the large owner-farmers obtained more than half of their credit from IN sources. The pattern in Comilla is similar. Government[25] sources supplied about 18 and 9 per cent of total IN credit in Phulpur and Comilla respectively.

The table also shows that farmers in Comilla obtained a larger percentage of their credit from IN sources, compared to farmers in Phulpur. For example, about 39 per cent of total credit in Comilla was supplied by IN sources. In Phulpur, IN sources supplied only about 23 per cent of total

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and relatives' supplied about 52% of total NIN credit. See the *Dacca University Socio-Economic Survey Board* [44]. Rural rich and the landlords supplied about 26%, and the professional moneylenders only about 5%. The 1967 *Survey Report* by the Registrar of Co-operative Societies [43], on the other hand, found that the professional moneylenders supplied about 45%, friends and relatives about 30% and landlords and rural rich about 16% of total NIN loans.

[23]The 1967 *Survey Report* by the Registrar of Co-operative Societies [43] also reported similar findings. The Survey found that in 1965, about 56% of all IN credit was supplied by the co-operatives, another 39% by the ADB and only 6% was advanced as *taccavi* loans by the government. Similar findings were also reported in Asaduzzaman and Hossain[3].

[24]ADB usually advances long term loans and hence requires tangible assets such as land, homestead, livestock as security.

[25]Government sources here refer to all IN sources except the Agricultural Development Bank (Bangladesh Krishi Bank) and the Co-operatives.

TABLE II

AVERAGE BORROWING (TAKA) PER BORROWING FARM HOUSEHOLD : PHULPUR, COMILLA, 1974/75

	Owner	Small	Medium	Large	Tenant	Group I	Group II	All Farms
ulpur								
mber of Borrowing Farms	41	18	15	8	32	13	19	73
al Number of Farms in each Category	91	43	37	11	46	19	27	137
erage Borrowing (Taka per borrowing farm)	602	477	581	925	475	433	503	546
centage of Total Loan Borrowed	61.9	21.5	21.8	18.6	38.1	14.1	24.0	(100)
milla								
mber of Borrowing Farms	35	22	9	4	16	4	12	51
al Number of Farms in each Category	81	61	16	4	21	5	16	102
erage Borrowing (Taka per borrowing farm)	577	430	750	1.000	508	278	585	555
centage of Total Loan Borrowed	71.3	33.4	23.8	14.1	28.7	3.9	24.8	(100)

TABLE III

SOURCES OF CREDIT BY SIZE GROUPS OF FARM HOUSEHOLDS : PHULPUR, COMILLA : 1974/75

(percentage of loans taken)

	Owner	Small	Medium	Large	**Tenant**	Group I	Group II	All Farms
ulpur								
fessional Moneylenders	28.9	41.7	22.6	11.1	21.9	8.4	29.0	25.8
nds and Relatives	42.7	41.3	48.8	36.1	36.4	43.3	32.8	39.9
dlords	—	—	—	—	21.7	17.0	24.2	9.6
al Rich	12.4	6.7	10.4	27.8	8.9	14.0	6.2	10.9
keting Intermediaries	8.0	2.9	9.5	16.7	6.1	13.1	2.4	7.2
pkeepers	4.2	4.8	2.6	5.5	2.0	—	3.0	3.2
ers	3.8	2.6	6.1	2.8	3.0	4.2	2,4	3.4
al NIN Loans (taka/farm)	**418.0**	**433.0**	**384 0**	**450.0**	**423.0**	**358.0**	**467.0**	**420.0**
	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)
vernment	10.7	19.0	15.3	5.3	49.6	46.7	53.8	17.7
icultural Development Bank	43.7	—	33.9	60.5	—	—	—	35.8
operatives	45.6	81.0	50.8	34.2	50.4	53.3	46.2	46.5
al IN Loans (taka/farm)	**184.0**	**44.0**	**197.0**	**475.0**	**52.0**	**75.0**	**36.0**	**126.0**
	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)
Sources (%)	69.4	90.8	66.1	48.6	89.1	82.7	92.8	76.9
Sources (%)	30.6	9.2	33.9	51,4	10.9	17,3	7.2	23.1
al Loans (taka/farm)	**602.0**	**477.0**	**581.0**	**925.0**	**475.0**	**433.0**	**503.0**	**546.0**
	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)

(Contd.)

TABLE III (*Contd.*)

(percentage of loans taken)

	Owner	Small	Medium	Large	**Tenant**	Group I	Group II	All Farms
Comilla								
Professional Moneylenders	33.7	29.4	50.0	20.0	24.2	—	27.1	30.1
Friends and Relatives	50.3	56.9	33.3	50.0	45.6	86.0	40.8	48.5
Landlords	—	—	—	—	20.5	14.0	21.3	7.9
Rural Rich	5 4	5.4	—	20.0	4.0	—	4.5	4.9
Marketing Intermediaries	4.0	2.9	8.3	—	2.0	—	2.2	3.2
Shopkeepers	1.7	1.2	—	10.0	0.6	—	0.7	1.3
Others	4.9	4.2	8.4	—	3.0	—	3.4	4.2
Total NIN Loans (taka/farm)	**304.0**	**316.0**	**300.0**	**250.0**	**417.0**	**178.0**	**496.0**	**340.0**
	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)
Government	8.5	32.5	—	—	9.1	—	12.5	8.6
Agricultural Development Bank	41.8	—	44.4	73.3	—	—	—	36.3
Co-operatives	49.7	67.5	55.6	26.7	90.9	100.0	87.5	55.1
Total IN Loans (taka/farm)	**273.0**	**114.0**	**540.0**	**750.0**	**91.0**	**1000.0**	**89.0**	**216.0**
	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)
NIN Sources	52.7	73.5	40.0	25.0	82.0	64.0	84.8	61.2
IN Sources	47.3	26.5	60.0	75.0	18.0	36.0	15.2	38.8
Total Loans (taka/farm)	**577.0**	**430.0**	**750.0**	**1000.0**	**508.0**	**278.0**	**585.0**	**555.0**
	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)

credit and the rest i.e., 77 per cent, was supplied by NIN sources. This once again shows the emphasis the government has placed on Comilla since the initiation of the pilot project in the early 1960s.[26]

Table IV presents information on the percentage of loans obtained by different farm household groups from some selected sources. The table clearly shows that small owner farmers and Group II tenants obtained the largest share of loans advanced by professional moneylenders and friends and relatives. This pattern holds true for all NIN loans taken together. However, for the IN sources, a different pattern can be observed. The medium and large owner farmers obtained the largest share of total IN

TABLE IV

PERCENTAGE OF LOANS OBTAINED BY DIFFERENT GROUPS OF FARM HOUSEHOLDS FROM SOME SELECTED SOURCES: PHULPUR, COMILLA, 1974/75

(percentage distribution)

	Owner	Small	Medium	Large	**Tenant**	Group I	Group II	All Farms
Phulpur								
Professional Moneylenders	62.7	41.1	16.5	5.1	37.3	4.9	32.4	100
Friends and Relatives	59.8	26.3	23.0	10.5	40.2	16.4	23.8	100
Rural Rich	63.8	15.7	18.1	30.0	36.2	19.6	16.6	100
Total NIN	55.8	25.4	18.7	11.7	44.2	15.3	28.9	100
Total IN	82.0	8.6	32.1	41.3	18.0	10.6	7.4	100
Total Loans	61.9	21.5	21.9	18.6	38.1	14.1	24.0	100
Comilla								
Professional Moneylenders	69.0	39.3	25.9	3.8	31.0	—	31.0	100
Friends and Relatives	63.8	47.1	10.7	6.0	36.2	7.3	28.9	100
Rural Rich	68.3	44.6	—	23.7	31.7	—	31.7	100
Total NIN	61.6	40.2	15.6	5.8	38.4	4.1	34.3	100
Total IN	86.4	22.6	36.7	27.1	13.6	3.6	10.0	100
Total Loans	71.3	33.4	23.8	14.1	28.7	3.9	24.8	100

[26] See Rahman [31].

loans advanced in both areas. For total loans (NIN and IN combined), no definite pattern can be observed although it can be said with reasonable confidence that the share of total loans increases as farm size decreases.

Appendix Table A presents information on the number of households obtaining credit from different sources. Since a single farm household can obtain credit from different sources, the sum of the column elements adds up to more than total at the bottom of each column. The main findings of the table may be summarised as follows:

a) In both areas, NIN sources of credit were more important for small owner-farmers and Group II tenants than for larger owner-farmers. For example, in Phulpur, 17 out of 18 (94%) small debtor farmers used NIN sources whereas this was true for only two out of eight (25%) large debtor farmers.

b) For the small owner-farmers, the category 'friends and relatives' is the most important source of credit followed by 'professional moneylenders'. For the Group II tenants, three NIN sources seem to be more or less equally important. These are 'friends and relatives', 'professional moneylenders' and 'landlords'. In Comilla, 'landlords' is the most important source of finance among the three sources mentioned above.

c) Among the IN sources, the government and the cooperatives seem to be more important for small owner-farmers and tenant farmers. The ADB is a more important source for the large owner-farmers.[27]

Uses of Credit

Rural households borrow credit for financing various kinds of expenditure. For example, the demand for loans may arise from a severely distressed situation when the income of a farm household is not sufficient to maintain a 'minimum consumption level'. It may also arise when a farm household can meet its food requirement but lacks funds to purchase other 'essential commodities'. On the other hand, some households may demand loans to augment their surplus for use on different kinds of investment which yield returns higher than the interest rates payable to creditors.

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[27] The findings of Table III may be compared with the findings of Rudra [34]. In a survey of some villages in West Bengal, Rudra found that 49% of villagers obtained general purpose loans from moneylenders, 39% obtained loans from other farmers, and 72% from shops and other sources (Table 6, p. 1052). Villages were taken as units of observation and three respondents from each village were selected, one each from the following categories: tenants, farm servants and casual labourers.

The loan repayment capacity of farm households is dependent on the pattern of use of loans and the rates of interest payable on such loans. The use of loans, in its turn, depends to a large extent on the nature of demand. If a borrower household has less income than its minimum consumption requirement, it is most likely to use the loans for consumption expenditure. It may, therefore, run the risk of perpetual indebtedness. Similarly, prolonged indebtedness may occur if interest rates are higher than the productivity of loans. It can be argued *a priori* that the poorer the farm household, or the larger the loans for consumption purposes or the larger the uses of interest bearing credit on non- or low-productive investment, the greater will be the risk of default and the more vulnerable the debtors are likely to be to usury credit.

An examination of the various purposes for which loans are used in the Survey areas are presented in Table V. The main features of the table are :

a) In both the Survey areas, high percentages of total (credit in Phulpur, about 38 per cent and in Comilla, about 30 per cent) were used for consumption purposes. A breakdown by size groups of farm households shows that the smaller owner-farmers and Group II tenants used high percentages of their credit for consumption purposes whereas this was not true for the large owner-farmers. For example, in Phulpur, the small owner-farmers and Group II tenants used about 59 and 64 per cent of their credit for consumption purposes. These facts demonstrate the vulnerability of small owner-farmers and Group II tenants to usury credit.

b) The largest use of credit by the large owner-farmers was on construction. The second largest use of credit in Phulpur was on various other unspecified items, while in Comilla, it was on agricultural implements.

c) Large owner-farmers used a higher percentage of their credit on items of capital expenditure (which includes items of both productive and non-productive assets) than small owner-farmers and Group II tenants. In Phulpur, for example, large owner-farmers used 54 per cent of their credit on such expenditure compared to the 7 per cent spent by the small owner-farmers. Group II tenants used about 8 per cent of their credit on capital assets compared to about 37 per cent by Group I tenants. In Comilla, the pattern was similar to that in Phulpur though the overall percentage of credit spent on capital assets was larger than that in Phulpur.

d) Percentages of loans spent on current inputs do not vary considerably over different size-groups of farm households. In Comilla, for

TABLE V

USES OF CREDIT BY FARM SIZE GROUPS : PHULPUR, COMILLA, 1974/75

(percentage of loans used)

	Owner	Small	Medium	Large	Tenant	Group I	Group II	All Farms
hulpur								
Capital Expenditure (a+b+c+d)	**27.5**	**7.0**	**25.2**	**54.0**	**18.5**	**37.2**	**7.0**	**24.1**
a. Agricultural Implements	(6.5)	(2.3)	(6.9)	(10.8)	(2.7)	(2.3)	(3.0)	(5.1)
b. Livestock	(3.6)	(—)	(5.7)	(5.4)	(4.6)	(5.8)	(3.9)	(4.0)
c. Construction	(11.7)	(4.7)	(8.0)	(24.3)	(8.8)	(22.7)	(0.6)	(10.6)
d. Purchase of Land	(5.7)	(—)	(4.6)	(13.5)	(2.4)	(6.4)	(—)	(4.4)
Current Farm Expenses (e+f)	**19.0**	**10.6**	**25.2**	**21.5**	**16.2**	**18.5**	**14.8**	**17.9**
e. Farm Imputs	(13.5)	(7.5)	(19.5)	(13.5)	(11.5)	(13.9)	(10.1)	(12.7)
f. Payment to Labour	(5.5)	(3.1)	(5.7)	(8.0)	(4.7)	(4.6)	(4.7)	(5.2)
Consumption	**30.9**	**58.7**	**29.5**	—	**49.2**	**24.1**	**64.0**	**37.9**
Repayment of Old Loans	**10.7**	**16 1**	**7.5**	**8.3**	**10.5**	**10.4**	**10.5**	**10.6**
Others	**11.9**	**6.6**	**12.6**	**16.2**	**5.6**	**9.8**	**3.2**	**9.5**
Total (1+2+3+4+5)	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(Contd.)

TABLE V (*Contd.*)

(percentage of loans used)

	Owner	Small	Medium	Large	Tenant	Group I	Group II	All Farms
illa								
apital Expenditure (a+b+c+d)	**26.6**	**12.3**	**28.3**	**57.6**	**9.3**	**37.8**	**4.8**	**21.5**
. Agricultural Implements	(9.7)	(2 7)	(15.0)	(17.5)	(2.9)	(5.4)	(2.5)	(7.7)
. Livestock	(5.7)	(0.9)	(13.3)	(4.0)	(3.0)	(22.3)	(—)	(4.9)
. Construction	(8.5)	(8.7)	(—)	(22.5)	(3.4)	(10.1)	(2.3)	(7.0)
. Purchase of Land	(2.7)	(—)	(—)	(13.6)	(—)	(—)	(—)	(1.9)
urrent Farm Expenses (e+f)	**21.2**	**16.2**	**28.9**	**19.9**	**21.7**	**37.0**	**19.3**	**21.3**
. Farm Imputs	(17.4)	(14.4)	(22.2)	(16.4)	(18.9)	(28.2)	(17.4)	(17.8)
. Payment to Labour	(3.8)	(1.8)	(6.7)	(3.5)	(2.8)	(8.8)	(1.9)	(3.5)
onsumption	**23.7**	**45.7**	**7.0**	—	**43.9**	—	**50 8**	**29.5**
epayment of Old Loans	**12.1**	**12.4**	**11.4**	**12.6**	**17.8**	**16.2**	**18 1**	**13.8**
thers	**16.4**	**13.4**	**24.4**	**9,9**	**7.3**	**9.0**	**7.0**	**13.9**
otal (1+2+3+4+5)	**100.0**	**100.0**	**100.0**	**100.0**	**100 0**	**100.0**	**100.0**	**100.0**

example, small owner-farmers used about 16 per cent on current inputs while large owner-farmers used about 20 per cent. The corresponding percentage for tenants was about 22.[28]

The number of farmers using credit for different purposes has a pattern similar to that observed above (see Appendix Table A). In Phulpur, out of 73 borrowers, 30 used credit on capital assets, 31 for current expenses, 26 on consumption, and 35 for repayment of loans and other items. The distribution over diffeient size groups shows that large proportion of small farmers used credit for consumption purposes. On the other hand, the number of small farmers using credit on items of capital expenditure was quite small. More or less the same percentages of large and small farmers used credit for current farm expenses. The pattern in Comilla was similar to that observed in Phulpur.

Terms and Conditions of Loans : Rates of Interest

Although small farmers generally use relatively larger percentage of credit for consumption purposes, their position need not be vulnerable if these loans are obtained without interest and without collateral. Table VI presents information on the relative importance of loans from NIN and IN sources without interest, and with monetary and non-monetary interest. The table shows that all the loans from the IN sources were with monetary interest. The percentage of NIN loans obtained without any interest were about 37 and 45 per cent in Phulpur and Comilla respectively.[29]

[28]Some comparable figures for all borrowing households may be presented here : Dacca University Socio-Economic Survey Board [44] reported that about 8%, 4% and 50% of loans were used for fixed capital assets, current farm expenses and consumption respectively. The 1967 *Survey Report* by the Registrar of Co-operative Societies [43] found the corresponding percentages as 26, 21 and 46 ; and the 1969/70 *BIDS Survey* on Phulpur (reported by Asaduzzaman and Hossain [3]) found the respective percentages as 9, 32 and 42. Thus, all the studies show that a high percentage of credit in Bangladesh is used for consumption purposes. Although uses of credit on fixed assets do not show any definite trend, the combined percentage of credits used on capital assets and for current farm expenses shows an increasing trend over time.

[29] Quasem, *et al.* [30] also observed that a significant proportion of loans in Bahalgachia village in Patuakhali district of Bangladesh was without interest. Their category of 'relatives' and 'neighbours' advanced about 77 and 66 per cent of their respective loans without any interest. However, in Modanpur (another village in the same district), only about a tenth of loans were advanced without interest. See Table 16, p. 88.

About 22 and 31 per cent of the NIN loans in Phulpur and Comilla respectively were with monetary interest and the rest i.e., 41 and 24 per cent, were with non-monetary interest. The percentages of loan-contracts[30] also show a similar pattern. About 49 and 39 per cent of NIN loan-contracts in Phulpur and Comilla respectively were without any form of interest attached. The percentages of loan-contracts with monetary interest in Phulpur and Comilla were about 25 and 38 respectively ; the corresponding percentages with non-monetary interest were 26 and 23.

TABLE VI

PERCENTAGES OF LOANS AND LOAN CONTRACTS WITH AND WITHOUT INTEREST : PHULPUR, COMILLA, 1974/75

	Phulpur			Comilla		
	IN	NIN	Total	IN	NIN	Total
Without Interest :						
Percentage of Loans	—	37	29	—	45	27
Number of Contracts	—	99	99	—	48	48
Percentage of Contracts	—	49	42	—	39	31
With Monetary Interest :						
Percentage of Loans	100	22	40	100	31	58
Number of Contracts	35	51	86	30	47	77
Percentage of Contracts	100	25	36	100	38	50
With Non-monetary Interest :						
Percentage of Loans	—	41	31	—	24	15
Number of Contracts	—	52	41	—	29	29
Percentage of Contracts	—	26	22	—	23	19
Total :						
Percentage of Loans	100	100	100	100	100	100
Number of Contracts	35	202	237	30	124	154
Percentage of Contracts	100	100	100	100	100	100

Note : IN : Institutional

NIN : Non-institutional

[30] A distinction has been made here between loans and loan contracts. Loans refer to the total amount of money obtained from a source during a specific period whereas loan contracts refer to individual loan negotiations. Thus, a farm household borrowing from moneylenders may enter into more than one loan contract and the terms and conditions of each contract may be different.

Table VII presents detailed information on loans from various NIN sources with and without interest. The main features of the table are as follows :

(a) Most of the loans from professional moneylenders were with interest. However, in some cases, personal contact with the professional moneylender resulted in interest-free loans. In Phulpur, for example, about 90 per cent of such loans were with interest and the rest were obtained interest-free.

(b) A significant proportion of loans from friends and relatives were obtained without interest. In Phulpur, for example, about two-thirds of the loans from this source were obtained without any interest. A large proportion of loan contracts (approximately 75%) negotiated with friends and relatives were also free of interest.

(c) A number of other sources also advanced interest-free loans. For example, in Phulpur, shopkeepers and 'others' advanced about 55 and 44 per cent of their loans without interest. The landlords and rural rich, on

TABLE VII

PERCENTAGE OF NIN LOANS AND LOAN CONTRACTS WITH AND WITHOUT INTEREST FROM DIFFERENT SOURCES : PHULPUR, COMILLA, 1974/75

Sources	% of Loans		% of Loan Contracts	
	With Interest	Without Interest	With Interest	Without Interest
Phulpur				
Professional Moneylenders	88.9	11.1	77.1	22.9
Friends and Relatives	33.2	66.8	25.9	74.1
Landlords	82.6	17.4	45.2	54.8
Rural Rich	78.2	21.8	52.2	47.8
Marketing Intermediaries	100.0	—	100.0	—
Shopkeepers	55.4	44.6	57.1	42.9
Others	44.0	56.0	39.1	60.9
Total	**63.0**	**37.0**	**51.0**	**49.0**
Comilla				
Professional Moneylenders	100.0	—	100.0	—
Friends and Relatives	16.3	83.7	31.6	68.4
Landlords	91.4	18.6	72.7	27.3
Rural Rich	76.0	24.0	60.0	40.0
Marketing Intermediaries	100.0	—	100.0	—
Shopkeepers	54.8	45.2	44.4	55.6
Others	72.0	28.0	54.5	45.5
Total	**55.0**	**45.0**	**61.0**	**39.0**

Note : NIN : Non-institutional

the other hand, advanced about 17 and 22 per cent of their loans without interest. In Comilla, interest-free loans supplied by various sources were as follows : shopkeepers (45%) ; rural rich (24%) ; landlords (19%) ; and others (28%). The discrepancy between percentage of loans and loan contracts (without interest) indicate that the average magnitude of loans without interest is smaller than that with interest.

(d) Marketing intermediaries in both areas did not supply any interest free loans.

(e) On the whole, about 37 per cent of NIN loans and 49 per cent of corresponding loan contracts were without interest in Phulpur. These percentages for Comilla were 45 and 39 respectively.

Calculation of interest rates on loans from NIN sources presents some difficulties as a portion of such loans are made in kind and hence kind rates of interest were payable on them. Calculation of kind rates of interest involves valuation of commodities advanced as loans and refund liabilities. In a situation where market for many of these commodities does not exist, imputation of values becomes difficult. Moreover, in many cases, the interest rates attached to the loans are concealed in the sense that loan liabilities in terms of quantity remain constant whereas repayment is made time specific. Thus a debtor borrowing one maund of paddy immediately after the harvest might be asked to pay it back in lean agricultural periods when the prices are high. In most cases, however, kind loans are fixed in terms of money ; but it is the creditor who fixes the price and dictates the terms of repayment. Creditors often overestimate the prices of commodities advanced as loans and underestimate the prices of repayable commodities.

Table VIII shows that the highest rate of interest in the Survey areas was charged by the professional moneylenders. The monetary and kind rates of interest charged by them were about 100 and 150 per cent per annum. Marketing intermediaries also charged very high rates of interest varying from 100 to 150 per cent per annum. Rates of interest charged by landlords were the third highest and were in the range of 50 to 100 per cent per annum. The main points to note from the table are that (i) in general, the rates of interest on loans from NIN sources were very high ; (ii) rates of interest charged by the landlords were not as high as those by the professional moneylenders and marketing intermediaries and (iii) kind rates were higher than monetary rates of interest.

TABLE VIII

AVERAGE RATES OF INTEREST ON LOANS FROM VARIOUS NON-INSTITUTIONAL SOURCES : PHULPUR, COMILLA : 1974/75

(Taka per annum)

Sources	Phulpur		Comilla	
	Implicit Kind Rates of Interest*	Money Rates of Interest*	Implicit Kind Rates of Interest*	Money Rates of Interest*
Professional Moneylenders	158	116	143	95
Friends and Relatives	45	32	36	25
Landlords	98	79	65	56
Rural Rich	61	64	57	53
Marketing Intermediaries	132	—	105	—
Shopkeepers	50	50	43	37
Others	75	68	64	60

Note : *Weighted averages (weighted according to the amount of loan).

Collaterals and Securities

Loans in rural credit markets are usually advanced against some form of security. In view of the unorganised nature of the rural credit market, stringent terms and conditions are often attached to securities. Availability of loans therefore depends on the types of security farmers are able to offer. Loans from IN sources are usually offered against land and other forms of marketable securities. The poor farmers and landless agricultural labourers, who can not offer such securities, face difficulties in obtaining loans from IN sources. In the NIN credit market however, various other forms of securities are accepted. Those offered and accepted depend on the debtor-creditor relationship. A brief discussion of the four main types of securities offered in the NIN credit market, and the terms and conditions under which they are offered, is presented below :

a) **Land** : Transfer of the use of land is the most common form of land security. Land is mortgaged to the creditor under different conditions, the extreme form being the ultimate transfer of the ownership right of land if repayment of principal plus interest is not made within a specified time. More moderate forms of land securities are variously known as *Khaikhalashi, Daishudi, kot and saf kobla, chukti kobla*, etc. Among these, *khaikhalashi* is the most common form. It essentially means the transfer of the ownership right of land for a specific period. After this period,

the loan is considered repaid and the debtor reclaims his ownership right. The others are variations of this form. One other common form is the transfer of the ownership right of land until such time as the principal and interest are considered to have been paid in full. This kind of land security, therefore, is quantity-specific whereas the former is time-specific. In *khaikhalashi* and other moderate forms of land security, land is usually kept under the occupancy of debtors under share-cropping and related arrangements.

b) **Labour** : The obligatory supply of labour on creditors' land is another common form of security, especially among small farmers, tenants and landless labourers who do not have adequate land to offer as security. This type of security takes various forms—the most extreme form being the bondage of labour to creditors for a pre-specified period during which the debtors have no right to seek employment elsewhere. The wage rate is fixed by the creditor and the wage bill is deducted from the debtor's repayment liability. The debtor remains bonded to the creditor until the loan is paid back in full. A more moderate form of labour security is the supply of labour on demand by the creditor, when the debtor is usually free to seek outside employment. Wage rates in most cases compare favourably with prevailing market wage rates although there are some instances, especially in the cases of agricultural labourers, where the wage rates are below market rates.

c) **Product** : The form of product security or the *dadan* system is more common among trader-creditors, e.g., *beparis*, *fariahs* etc. Under this form of security, loans are usually advanced against standing crops and obligatory sale to creditors. The prices fixed are usually lower than the prevailing market prices.

d) **Others** : Apart from land, labour and product, various other assets are accepted as securities. These may vary from homesteads and agricultural machinery to different types of durable goods, like jewellery. The movable tangible securities are usually deposited with the creditor and reclaimed when the loan is repaid. In case of default, the creditor imputes a value to the assets which is then deducted from the outstanding debt liability.

Table IX gives information on the various forms of security attached to NIN loans in the Survey areas. The table shows that in Phulpur 107 out of 202 (about 53%) loan contracts, and in Comilla 72 out of 124 (about 58%) loan contracts from the NIN source had some form of security attached to them. The main features of the table are :

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TABLE IX

RELATIVE IMPORTANCE OF DIFFERENT TYPES OF SECURITY IN NON-INSTITUTIONAL CREDIT MARKET : PHULPUR, COMILLA, 1974/75

	Owner	Small	Large	Medium	Tenant	Group I	Group II	All Farms
Phulpur								
Total No. of Loan Contracts	93	45	37	11	109	33	76	202
No. of Loan Contracts with Some Form of Security	46	25	17	4	61	19	42	107
% Distribution of above with Security as :								
Land	43.5	48.0	35.3	50.0	41.0	57.9	33.3	42.1
	(20)	(12)	(6)	(2)	(25)	(11)	(14)	(45)
Labour	19.6	28.0	11.8	—	32.8	26.3	35.7	27.1
	(9)	(7)	(2)	—	(20)	(5)	(15)	(29)
Product	19.6	12.0	23.5	50.0	13.1	10.5	14.3	15.9
	(9)	(3)	(4)	(2)	(8)	(2)	(6)	(17)
Others	17.4	12.0	29.4	—	13.1	5.3	16.7	14.9
	(8)	(3)	(5)	—	(8)	(1)	(7)	(16)
Comilla								
Total No. of Loan Contracts	69	59	9	8	55	7	48	124
No. of Loan Contracts with Some Form of Security	39	31	5	3	33	3	30	72
%Distribution of above with Security as :								
Land	41.6	41.9	40.0	33.3	33.3	33.3	33.3	37.5
	(16)	(13)	(2)	(1)	(11)	(1)	(10)	(27)
Labour	12.8	16.1	—	—	27.3	—	30.0	19.4
	(5)	(5)	—	—	(9)	—	(9)	(14)
Product	35.9	32.3	40.0	66.7	12.1	33.3	10.0	25.0
	(14)	(10)	(2)	(2)	(4)	(1)	(3)	(18)
Others	10.3	9.7	20.0	—	27.3	33.3	26.7	18.1
	(4)	(3)	(1)	—	(9)	(1)	(8)	(13)

Note : Figures within parentheses represent the number of loan contracts.

Number of observations in some cases (especially in the case of large owner farmers) are quite small, and hence, the percentages calculated on the basis of these observations must be treated with caution.

i) Land was found to be the most important form of security in both the Survey areas. About 42 and 38 per cent of all NIN loan-contracts in Phulpur and Comilla respectively had this as security. Importance of land as security, moreover, did not show significant variation over different groups of farm households.[31]

ii) Among other forms of securities, labour was next in importance. About 27 and 19 per cent of loan-contracts in Phulpur and Comilla respectively had this form of security. It was found to be more common among tenants and small owner farmers, especially the Group II tenants. For example, in Phulpur, 36 and 28 per cent of loan-contracts with the Group II tenants and small owner farmers respectively had labour as security. Large owner farmers, on the other hand, did not negotiate any loan on this basis.

iii) Product security was more common among the large owner farmers. In Phulpur, this accounted for 50 per cent of loan-contracts of the large owner farmers. In Comilla, the corresponding percentage was about 66.

The findings of Table IX can now be linked up with earlier findings in order to relate the availability of loans with that of collaterals. The table shows that in the NIN credit market, land is the most common form of security. Small land owners and Group II tenants are obviously constrained somewhat in offering land security and hence they also offer labour and product as collaterals. On the other hand, the large landowners are not constrained, but they also offer product security. However, they don't offer labour as a collateral. Incidently, the IN sources primarily accepts land and product security and hence it is the large owners who are in a better position to take advantage of this situation. This partly explains why the large landowners obtain more of their loan requirements from IN sources.

Landlord-tenant Credit Relationship

Thus far we have mainly concentrated on describing the general credit relations in the Survey areas. Although some features of landlord-creditors have been presented, these are inadequate to assess the landlord tenant credit relationship. In this sub-section we, therefore, concentrate on this specific aspect of credit relations in the Survey areas.

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[31] Quasem, *et al.* [30] also found that land was the most acceptable form of security, and it covered 34.7% of loans at Madanpur and 47% of loans at Bahalgachia in the Patuakhali district of Bangladesh. They further observed that a significant proportion of loans (31.7% and 45.8% in Madanpur and Bahalgachia respectively) were advanced without collaterals (see Table 14, p. 86).

Table X provides information on the percentages of tenant households obtaining production and consumption loans (with and without interest) from landlords in the Survey areas. About 44 and 52 per cent of tenants in Phulpur and Comilla respectively obtained some form of loan from landlords. In Phulpur, about 20 and 11 per cent of the tenants obtained production loans from the landlords with and without interest respectively. The corresponding percentages for Comilla are 38 and 18. On the other hand, about 28 and 9 per cent of the tenant farmers in Phulpur negotiated consumption loans from the landlords with and without interest respectively. The corresponding figures for Comilla are 43 and 14. The table highlights the fact that a substantial percentage of tenant farmers negotiate production loans from landlords and approximately a third of such loans are interest free. Between a quarter to one-third of the consumption loans from landlords were also obtained without any interest.[32] The table also shows that about half the tenants did not have any credit relations with landlords.

TABLE X

PERCENTAGE OF TENANTS OBTAINING PRODUCTION AND CONSUMPTION LOANS FROM LANDLORDS : PHULPUR, COMILLA, 1974/75

Areas	% of Tenant Households Obtaining Loans from Landlords	Percentage of Tenants Taking			
		Production Loans from Landlords		Consumption Loans from Landlords	
		With Interest	Without Interest	With Interest	Without Interest
Phulpur	43.5	19.6	10.9	28.3	8.9
	(20)	(9)	(5)	(13)	(4)
Comilla	52.4	38.1	18.2	42.9	14.3
	(11)	(8)	(2)	(9)	(3)

Note : Figures within parentheses show the number of farms.

[32] Bardhan and Rudra [5] in a survey of some areas in East India found that about 52% of the tenants obtained consumption loans from landlords, of which about 11% were without any interest. In the case of West Bengal, they found that about 52% of tenants obtained loans from their landlords, of which 23% were interest free (Table 3, p. 369). They also found that, in East India, about 27% of tenants obtained production loans from landlords with interest and another 15% without interest (Table 6, p. 371).

Table XI gives information on the rates of interest charged by the landlords on loans advanced by them. It has been previously observed that the rates of interest charged by landlords are generally lower than those charged by professional moneylenders or marketing intermediaries. The table here shows that the rates of interest charged on consumption loans are higher than on production loans and the rates of interest on kind loans are higher than those on monetary loans.

Table XII presents information on the percentage of landlords advancing loans to tenants and usury and rental income as percentages of the total income of landlords. The table shows that slightly more than half the landlords in both areas advanced loans to tenants. But usury income as a percentage of their total income was only about 5.3 and 4.8 in Phulpur and Comilla respectively. On the other hand, about 20 and 28 per cent of landlord income in Phulpur and Comilla respectively originated from rent. It appears, therefore, that rental income was more important to landlords than usury income.

TABLE XI

RATES OF INTEREST ON LOANS FROM LANDLORDS : PHULPUR, COMILLA, 1974/75

Areas	Rates of Interest on Production Loans		Rates of Interest on Consumption Loans	
	Money*	Implicit Kind*	Money*	Implicit Kind*
Phulpur	54	85	102	130
Comilla	48	63	68	78

Note : *Weighted average (weighted according to the amount of loan advanced).

TABLE XII

PERCENTAGE OF LANDLORDS ADVANCING LOANS TO TENANTS AND INCOME FROM USURY AND SHARE/RENT AS A PERCENTAGE OF LANDLORDS' INCOME : PHULPUR, COMILLA, 1974/75

	Phulpur	**Comilla**
Number of Landlords in the Sample	26	12
Number of Landlords Advancing Loans to Tenants	17	7
% of Landlords Advancing Loans to Tenants	65	58
Usury Income of Creditor Landlords as a % of their Total Income	5.3	4.8
Share/Rent Income of Creditor-Landlords as a % of their Total Income	20.3	27.7

Table XIII provides information on the principal occupations of landlords in the two Survey areas. It should be noted that the number of landlords in the previous table does not correspond to the number presented here because in the former only the landlords in the samples were counted whereas here, the landlords of all tenants interviewed have been included. This category, therefore, include some landlords who were not in the sample.

The table shows that more than half the landlords were engaged in self-cultivation in both areas, and another 14-17 per cent were engaged in trade and business. Moneylending as a principal occupation was reported for only two landlords in Phulpur. In Comilla, none reported this as the major occupation. Share/rent receiving was listed as the principal occupation for 7 and 10 per cent of landlords in Phulpur and Comilla respectively. Other activities, such as outside jobs and other production activities, etc., were reported for 13 per cent of landlords in Phulpur and 29 per cent of landlords in Comilla.[33]

Lastly, Table XIV presents some selected aspects of credit relations of all debtors and debtor-tenants in the NIN credit market. The following observations can be made from the table:

a) The percentage of debtor-tenants pledging land security in the two Survey areas was higher than the corresponding figure for all debtors. For example, in Phulpur, ten out of twenty (50%) tenant-debtors pledged land

TABLE XIII

PRINCIPAL OCCUPATION OF LANDLORDS : PHULPUR, COMILLA, 1974/75

Areas	No. of Landlords	Percentage of Landlords having				
		Self-Cultivation as Principal Occupation	Trade & Business as Principal Occupation	Money-lending as Principal Occupation	Share/Rent Receiving as Principal Occupation	Other Activities as Principal Occupation
Phulpur	30	53	17	7	10	13
		(16)	(5)	(2)	(3)	(4)
Comilla	14	50	14	—	7	29
		(7)	(2)	—	(1)	(4)

Note : This information has been obtained from tenants. Figures within parentheses represent the number of landlords.

[33]Bardhan and Rudra [5] found that in East India the principal occupation of 68% of the landlords (of the tenants in the sample) was self cultivation. About 7, 3 and 17% of landlords reported trade, moneylending and other activities respectively, as their principal occupation (see Table 4, p. 364).

as security whereas this was true for 24 out of 59 (41%) debtor farmers. The percentage of land area pledged as security was also higher for debtor-tenants than for all debtors.

TABLE XIV

SOME INFORMATION ON COLLATERALS FOR ALL DEBTORS AND TENANT DEBTORS IN THE NIN CREDIT MARKET : PHULPUR, COMILLA, 1974/75

	Phulpur	Comilla
All Debtors :		
Number of Households	59	34
Number of Debtors Pledging Land as Security	24	15
% of Total Owned-Land Pledged	11.4	15.3
Number of Households Reporting Transfer of Land to Creditors during the Last Three Years	6	4
Number of Debtors Taking *Dadan*	10	7
% of All Debtors	16.9	20.6
Number of Debtors Pledging Labour as Security	7	5
% of All Debtors	20.3	20.6
Number of Debtors Pledging Other Securities	7	5
% of All Debtors	11.9	14.7
Tenant Debtors :		
Number of Households	20	11
Number of Debtors Pledging Land as Security	10	5
To Landlords	(7)	(3)
To Others	3	2
% of Total Land Area Pledged		
To Landlords	(14.6)	(18.1)
To Others	(10.3)	(14.9)
Number of Households Reporting Transfer of Land to Creditors during the Last Three Years	3	2
To Landlords	(2)	(2)
To Others	(1)	(—)
Number of Debtors Taking *Dadan*	7	5
With Landlords	(2)	(1)
With Others	(5)	(4)
Number of Debtors Pledging Labour as Security	8	4
To Landlords	(6)	(3)
To Others	(2)	(1)
Number of Debtors Pledging Other Securities	3	2
To Landlords	(1)	(1)
To Others	(2)	(1)

b) The percentage of debtor-tenants reporting transfer of the ownership right of land to creditors during the last three years was slightly higher than for all debtors. However, the percentage of debtor-tenants reporting transfer of land to landlords was lower than the percentage of all debtors.

c) A higher percentage of debtor-tenants took *dadan* (product security) than all debtors. *Dadan* was not very common with landlords and only about a quarter of tenants negotiating with this form of security reported doing so with the landlords.

d) A larger percentage of debtor-tenants than all debtors pledged labour as security to all creditors and landlord-creditors.[34]

e) Similarly, a larger percentage of debtor-tenants pledged other forms of securities to all creditors and landlord-creditors than the corresponding percentage of all debtors.

f) Debtor-tenants had credit relations with other creditor groups as well and their relationships with landlords were not found to be significantly different from those of the other creditor groups. Also the tenant-landlord credit relation was not found to be very dissimilar to that between other debtors and creditors.

IV. EMPIRICAL VALIDITY OF THE MODELS DISCUSSED IN SECTION II

This section summarises some of the observations about credit relations in the Survey areas in order to examine the empirical validity of the models discussed in Section II. The discussion should also help in the clarification of certain issues which are threaded together in the next section to (a) provide an alternative analysis of the observed credit relations, and (b) examine their implications for capital formation and capitalist growth.

Let us first consider Bhaduri's first model [6]. As already discussed, Bhaduri tried to explain the persistence of stagnation in a backward semi-feudal agriculture through a formalised and significant landlord-tenant credit relationship. In the model, landlords were assumed to have full control

[34]Bardhan and Rudra [5] found that in West Bengal only 9.9% of tenants who owned land worked for landlords, but a high 52.2% of tenants without land supplied labour to the landlords (Table 10 A). They also found that 92% of the tenants who provided labour to the landlords were properly paid and no owner-tenant was unpaid. Of the pure tenants about 58% were properly paid while about 21% were unpaid (see Table 10 B).

over tenants, power being exercised by regulating the flow of income to the tenants *ex ante* through inhibiting innovation and investment and *ex post* through the appropriation of the surplus product. Tenants were assumed to have no decision-making power. Section I has already spelled out the assumptions behind the model. In order to examine their validity in the Survey areas, let us briefly recapitulate some of the observations on credit relation described so far in the previous section.

i) It was observed in the Survey areas that landlords do not have significant credit relations with tenants. First, the landlord was not found to be the sole supplier of finance since tenants had access to other NIN sources. Moreover, the percentage of tenants obtaining loans from other NIN sources was found to be higher than the percentage of tenants obtaining loans from landlords. Thus, assuming that credit relations in a subsistence and backward agriculture imply a certain domination and submission, the landlords (in the Survey areas) cannot be said to be the only group in control. A model to explain persistent stagnation must, therefore, incorporate the relations of tenants and other marginal groups of farm households with all other creditor groups. Second, a substantial part of the loans received by tenants were interest free. Slightly more than half the loans were advanced to tenants and of these only 5 to 10 per cent were interest-payable. Further, a large proportion of the loans advanced by other sources were also without interest. Tenants with a total dependence on loans provided by landlords (i.e. , those who do not obtain loans from any other source) were found to be very rare. Moreover, less than a tenth of the total land was cultivated by tenants who obtained loans from landlords. Therefore, any disincentive effect arising from landlord-tenant credit relations is likely to be minimal. Third, about half the loans advanced by landlords were used for production purposes. The interest rates on such loans were also observed to be lower than those on consumption-loans. Such loans were made for the express purpose of innovation and the purchase of improved inputs. Therefore, although the landlords might not have actually involved themselves in long-term investment on leased-out land, they nevertheless encouraged the tenants to innovate through an increased provision for working capital.

ii) Usury income as a percentage of total income of landlords was found to be rather insignificant. It was observed that only about 4 to 5 per cent of the total income originated in usury. On the other hand, about 20 to 28 per cent was derived from rent income. It therefore seems reasonable that if landlords desire to appropriate the surplus pro-

ducts of tenants, they can do so through a small percentage change in the share of the produce rather than through significant variations in the interest rates charged on loans. This has an added advantage : whereas significant variations in interest rates may drive tenants to seek alternative sources of finance, variations in the share or rent, even if small, will leave the tenants no alternative. They simply cannot afford to give up their cultivation. This point complements the earlier theoretical point that, in a labour surplus pre-capitalist agriculture, the surplus product is primarily appropriated through land rent and that usury, as a mode of appropriation of surplus value, is redundant.

iii) The above arguments are complemented by the fact that moneylending, as a principal occupation, was found to be very rare among landlords. For a large percentage, self-cultivation was the principal occupation. Consideration of usury income, therefore, is likely to play, if at all, only a minor role in the decision-making process of the landlord-creditor.

iv) It may be argued that although usury income constitutes a small part of the total income of landlords, the transfer of collaterals is one of the major ways of appropriating the surplus product of tenants. It was observed in the Survey areas that a higher percentage of the loans from landlords than from other NIN sources was advanced against some form of security. However, the difference was not very significant. Further, the extent of transfer of collaterals to landlord was not found to be significantly different from that of other groups of NIN creditors, and the overall extent of such transfers due to default on loans was rather insignificant.

v) On the basis of the information on input and output sharing practices in the Survey areas, the following observation on the landlord-tenant relationship can be made. First, although landlords advanced production loans to tenants, their participation in input-sharing was not found to be very significant. About two-thirds of the tenants reported that no part of the production cost was shared by the landlords. Only in 5 and 12 per cent of cases in Phulpur, and Comilla respectively did the landlords bear a part of input cost by providing the seed requirements. Except for participation in irrigation, the pattern (of non-involvement) was observed to be the same for all other inputs. Coupled with the general observation that landlords do not dictate the choice of inputs, it may be argued that tenants are 'free' to make their own decisions about innovation and investment. Even when there was input-sharing, say in irrigation facilities, tenants were free to choose other inputs. Second, there are instances of the traditional share-cropping arrangement (on 50:50 basis)

being modified when tenants innovate. In Comilla particularly, it was observed that the traditional share-cropping system was gradually being replaced by a fixed renting system in response to the rapid spread of new technology in that area. This, however, does not mean that tenants necessarily benefit from the change. They bear all the risks and by changing the rental, the landlords are in a position to appropriate a part, if not all, of the benefits.

The above discussion is not an attempt to dispute the view that under certain circumstances it pays the landlords to discourage innovation by tenants. The purpose is rather to show that Bhaduri's model provides, if anything, only a partial explanation of the lack of innovation and perpetual stagnation in a backward pre-capitalist agriculture. To the extent that the theoretical arguments presented (at the beginning of this paper) and the empirical observations discussed come into conflict with the basic assumptions of Bhaduri's model, they reduce its operational significance. Bhaduri's model relates only to a very small and rather insignificant part of the rural credit and land markets. The fact that some of the tenants obtain part of their loan requirements from landlords does not necessarily make them 'serfs' of the landlords nor does it mean that they are 'unfree' and dependent on landlords' approval for innovation and investments.[35]

The observations on credit relations in the last section also raises some points pertinent to the Bhaduri-Prasad theory [7 ; 29] of extra-economic coercion and the appropriation of collaterals through usury. However, it is not possible, nor is it intended to test them formally. The purpose here is to raise some empirical points about the models.

The Bhaduri-Prasad models were advanced to explain the existence of high rates of interest in unorganised rural credit markets. The appropriation of collaterals was argued to be the main motive force behind such high rates of interest. Our analysis of credit relations in the last section enables us to make the following points. First, it was observed in the Survey areas that a large percentage of the loans in the NIN credit market were interest free ; furthermore, a substantial portion of these loans were used for current and fixed capital expenditure. The category 'friends and relatives' was found to be a major source of credit in the NIN credit market (this supplied slightly less than half of all loans) and about two-thirds of all loans advanced were free of interest. This source also charged a lower rate of interest in comparison to rates charged by other sources. Second, about two-thirds of all loans were given out

[35]For similar arguments and empirical observations in the context of Eastern India, see Bardhan and Rudra [5].

without any form of security attached to them. Third, although land was the most important form of security, the appropriation of land on default of loans was not found to be very significant. If the appropriation of collaterals was all that mattered in the decision of the creditors to charge high rates of interest, then one would naturally expect a higher incidence of land appropriation. Fourth, it was found that the highest rate of interest was charged by professional moneylenders. It can be argued that this group is less interested in the acquisition of landed property and other collaterals than, say, the landlords. If it is assumed that collaterals are non-marketable then it seems unlikely that professional moneylenders would encourage default. Neither do they have any clearly defined motive for appropriating the collaterals (if they cannot be sold). The assumption of non-marketability of collaterals therefore has to be dropped. This, however, means that tenants could equally sell their assets in the market to pay back outstanding debts. Logically, therefore, it is the assumption of differential access to markets for collaterals, rather than the stronger assumption of 'non-marketability', which is necessary to maintain the 'validity' of the Bhaduri-Prasad models.

Once again the empirical observations on credit relations in the Survey areas do not permit us to accept the Bhaduri-Prasad theory as a general explanation of the way interest rates are formed in unorganised rural credit markets. A significant part of the market is left unexplained, and the models provide, if anything, only a very partial explanation of the observed behaviour. Further, the earlier model, along with the above two, are of little help to an understanding of how such credit relations hinder the process of transition to a capitalist mode of production.

V. THE ROLE OF RURAL CREDIT MARKET IN A PRE-CAPITALIST AGRICULTURE : AN ALTERNATIVE ANALYSIS

It has been argued earlier that the neo-Marxist view that usury capital in a pre-capitalist agriculture impedes the emergence of the capitalist mode of production provides only a partial analysis of rural credit relations in the Survey areas and also in many parts of Eastern India. The assumption of this theory that usury is the primary mode of appropriation of surplus product has been questioned. It is true that usury provides a legal and cheap mechanism for the appropriation of collaterals. The fact that it has not been observed in the Survey areas, or in many parts

of Eastern India, may be due to the incomplete nature of information available in these surveys. What remains to be explained by the neo-Marxist models, however, is the fact that a substantial portion of the loans are advanced in the unorganised rural credit market without any interest and without any apparent motive for appropriation.

It may be asked whether the lenders of such loans are irrational economic agents attaining sub-maximal levels of income. The answer to this question is vital if our analysis of observed rural credit behaviour is to be coherent and complete. This section attempts such an analysis. It should be pointed out that our attempt deliberately does not venture into a discussion of the recent analyses of the share-cropping system and its disincentive effects.[36] nor do we forward a Smithian analysis of share-cropping arrangements,[37] Further, we do not try to answer the question by pointing out simply that the neo-Marxist position misses the basic point that the financial constraints of small farmers and the tenants restrict their desire for innovation and investment.[38] We also do not point to the extravagant lifestyles of the rich farmers and landlords which may allure them to attach a high discount rate on future streams of income in an attempt to explain the lack of an apparent motive for appropriation. The answer, on the contrary, is sought in the reality of the backward nature of agriculture and certain political-behavioural attitudes. *The basic proposition is that the existing agrarian structure benefits both landlords and other dominant groups of farm households as well as tenants and other poorer strata of the peasantry.* The continuity of the prevailing agrarian structure is, however, more important for the interest of the dominant group of farm households. The rural credit market helps to ensure its continuity by redressing any imbalances introduced by exogenous factors, e.g., natural disasters, famines or even new technology. Thus, rural credit markets

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[36]For a brief discussion of the disincentive effects of share-cropping, see Rahman [31], Chapter IV. A particular brand of a rather unconvincing argument, forwarded by Newbery [27], is that since the landlords are also not aware of the input requirements of a new technology, they would be unable to check whether the tenants had supplied the stipulated inputs from the levels of output, and would therefore reject the new technology.

[37]The classical position of the disincentive effects of share-cropping, arising from tenurial insecurity, first enunciated by Adam Smith in the context of metayer system, was later revived by Marshall [23] and Johnson [16].

[38]This approach to explain the lack of innovation in a backward agriculture has been suggested, in the context of India, by Ladejinsk [19 ; 20 ; 21] ; Thorner [41] ; Rao, C.H.H [32] ; and Kurup [18].

respond to changes in the techniques of production and innovation and adjust accordingly. This is not to say that other markets remain passive. They also react to change. For example, land rentals or tenancy contracts may be modified when new technology is adopted. The rural credit market therefore remains a balancing force : subsidising the peasantry when their conditions worsen or their existence is threatened and appropriating the extra-benefits when innovation and investment take place.[39] A brief discussion of this proposition is presented below :

First, let us consider the supply of interest-free loans by the group 'friends and relatives'. In the Survey areas, it was found to be the largest single source of interest-free loans. The supply of interest-free loans by this group may be seen as an insurance against uncertainties in the future. In times of need (say, due to harvest failure), farmers approach their friends and relatives (who are usually of similar economic status in terms of income and land holdings) for loans. They are usually obliged to give interest-free loans because, given the uncertain nature of the labour market, a harvest failure sometime in the future may tilt the scales and force the creditors of today to seek assistance from the deficit farmers they are helping now. The personalised nature of credit relations guarantees recovery of loans.

Second, for other groups, such as landlords and other rich farmers, the supply of interest free loans may also be explained along similar line. The landlords, for example, are aware of the limitations of usury as a mode of appropriation of the surplus product unless transfers of the ownership rights of land and other collaterals are sought. They may therefore use credit to strengthen other markets, e.g., land and labour. They may also advance loans to landless labourers and tenants to ensure the supply of labour in peak agricultural periods. Although such loans may strengthen the contractual bond of tenants and landless labourers to landlords, this may not be for the express purpose of creating a serf-landlord relationship. On the contrary, landlords may be simply motivated to minimise loss of income and social status. For example, a landlord may be interested to minimise his loss of crop income by supplying credit to tenants and landless labourers and thereby obliging them to provide labour during peak periods (not necessarily at wage rates below the market rate). Or, landlords and

[39]It is not possible for us to substantiate the latter part of this statement i.e., creditors appropriate the extra-benefits when innovation and investment takes place. Therefore, it is to some extent conjectural. However, loan repayment records of farm households in the Survey areas show that repayments mostly occur in good agricultural periods. This provides a partial justification of our statement.

other rich farmers may be interested to maintain cohesion in their local political regime by providing loans at a low or zero rate of interest. Or, they may even advance loans to tenants and landless labourers to ensure the reproduction of debtors' labour. The primary purpose, in all these cases, is to maintain the continuity of the prevailing agrarian structure.

So far as the existing structure is maintained and resources utilised in credit markets to buttress the existing pre-capitalist structure, rural credit markets may be seen as barriers to change and capitalist growth. Resources after all are diverted away from more productive channels and this results in low rate of capital formation. One can, however, question the assumption that return from moneylending in an unorganised rural credit market is higher than the return on productive assets. It is very difficult to provide empirical answer to this question as some of the benefits accruing to 'creditors' are not measurable. However, some simple calculations reveal the relative rates of return on money lent in unorganised rural credit markets and total capital employed in agriculture. These are presented in Table XV. The calculations are based on the assumption that interests on interest-bearing-credit are paid, or in the case of default, an equivalent amount of assets or collaterals are appropriated.

It can be observed from the table that the rate of return on interest-bearing-credit in both the Survey areas is higher than the average rate of return on total agricultural capital employed. In Phulpur, the return on all credit (interest plus non-interest bearing credit) is also higher than the average or marginal rates of return on total capital employed. In Comilla, however, the return on all credit is lower than both the average and marginal returns. The higher return on total capital employed in Comilla than in Phulpur can be explained by the fact that Comilla experienced a higher rate of adoption of new technology and had better access to different government agencies supplying complementary inputs. The calculations show that in a backward agriculture, moneylending can be at least as lucrative as investment on land. Another important point to note is that when new technology is introduced the difference in the returns is narrowed down, and in some cases the return on total capital employed may even be higher than the return on moneylending.

Thus, the rural credit market in a pre-capitalist agriculture may restrain capital formation and capitalist growth in as much as it (a) helps to maintain the existing agrarian structure, and (b) diverts resources away from productive channels. However, it is questionable whether the elimination of these restrictive effects would foster capital formation and capitalist growth. In order to have a complete and coherent analysis of

the constraints on capital formation and capitalist growth in a pre-capitalist agriculture, the nature of and restrictions imposed by other markets like land, labour and product must also be examined. Without such an analysis, the conclusions *per se* of this paper remain rather incomplete.

TABLE XV

RATE OF RETURN FROM MONEYLENDING AND ON TOTAL CAPITAL EMPLOYED[a] IN AGRICULTURE: PHULPUR, COMILLA, 1974/75

Areas	Number of Farms	Rate of Return from Moneylending[b]	Rate of Return on Total Capital Employed in Agriculture
Phulpur	29	68.3[c]	37.4[e]
		(40.6)[d]	(32.5)[f]
Comilla	18	54.4[c]	48.2[e]
		(37.5)[d]	(63.2)[f]

Notes :

[a]Total capital employed in agriculture includes value of land, agricultural implements and machinery, value of draught animals, etc. Return refers to net return from all agricultural activities. Cost of all inputs, cost of labour (own and hired), etc. have been deducted from gross returns. Average return is the weighted average of all returns and has been measured as the ratio of net returns to total capital employed multiplied by 100.

[b]Rate of return on moneylending has been calculated as the ratio of total interest payment to total loan advanced. Since the amount of loan advanced refer to the period 1973/74 and the interest payment is recorded for 1974/75, it is very difficult to find exact correspondence between loans and interest payment. Hence, these figures should be taken as indicative.

[c]Rate of return on interest bearing credit.

[d]Rate of return on all credit.

[e]Average rate of return.

[f]Marginal rate of return.

The marginal returns have been calculated by fitting two regression equations between total capital employed per acre of land and labour days employed per acre as independent variables and value of output per acre as the dependent variable. The coefficient of total capital employed per acre is the marginal productivity of capital. The fitted regression equation are reported below:

Phulpur : $Y = -153.2 + 32.5\,X + 3.4\,Z$ $\quad R^2 = 0.49$

$\qquad (1.8)^{*} \quad (2.9)^{**} \quad (2.1)^{**} \qquad N = 29$

Comilla : $Y = -239.6 + 63.2\,X + 4.5\,Z$ $\quad R^2 = 0.55$

$\qquad (3.2)^{**} \quad (4.1)^{**} \quad (3.4)^{**} \qquad N = 18$

* Significant at 90 per cent level of confidence.

** Significant at 99 per cent level of confidence.

Y : Net return per acre of land.

X : Total agricultural capital per acre of land (in hundred taka).

Z : Total Labour days per acre of land.

VI. SUMMARY

In classical and recent Marxist writings, usury is often considered to be an important factor hindering the process of transition from a pre-capitalist economy to a capitalist one. Recently, Bhaduri and Prasad (among others) have argued that in a semi-feudal agriculture, credit relations between landlords and tenants through interlinkages in land and labour markets impede innovation and investment by tenants. This paper first examined some relevant theoretical models and later, on the basis of observed credit relations in two Survey areas in Bangladesh, examined the empirical validity of the assumptions on which the models depend. It was observed in the Survey areas that (i) the landlord-tenant credit relation is only a marginal and a rather residual category of observed credit relations, and (ii) a significant part of credit from NIN source is provided for production purposes without interest and without any apparent motive for appropriation of collaterals. It was argued, therefore, that the Bhaduri-Prasad models provide only a partial explanation of the working of the rural credit markets in the Survey areas. So far as the observed credit relations are typical of Bangladesh, or of Eastern India, the Bhaduri-Prasad models need further qualification before they can claim generality, especially in a labour-surplus situation where surplus appropriation through usury assumes only secondary importance.

An alternative explanation of the observed relations was attempted towards the end of the article. It was argued that some part of credit may indeed be advanced for the appropriation motive ; but a large part is provided (i) to ensure the reproduction of debtors' labour, (ii) to ensure the supply of labour to creditors when demanded, and (iii) to maintain cohesion between the creditors' local political groups and factions. Credit advanced by friends and relatives can be seen as a kind of insurance scheme in which credit is provided today in anticipation of a reciprocal attitude when it may be necessary in the future. Further, it was argued that rural credit markets in a backward agriculture maintain the continuity of agrarain structure through the redressing of any imbalance in the interests of the different sections or classes of rural households.

Lastly, the implications of this role of rural credit market for capital formation and capitalist growth was analysed. In so far as the existing structure does not encourage increased innovation and investment because of, say, the disincentive effects of other markets, it can be argued that rural credit markets indirectly impede capital formation and capitalist growth. Further, some evidence from the Survey areas were adduced

in support of the argument that rural credit markets indeed divert capital away from productive channels. It was observed that rate of return on moneylending in unorganised rural credit markets was, in many cases, higher than returns from productive investment. The fact that the differential is smaller in Comilla than in Phulpur perhaps indicates that with the spread of new technology, a larger proportion of surplus would be used for productive investment.

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Appendix

TABLE A

NUMBER OF FARMS OBTAINING LOANS FROM DIFFERENT SOURCES : PHULPUR, COMILLA, 1974/75

	Owner	Small	Medium	Large	**Tenant**	Group I	Group II	All Farms
Phulpur								
Professional Moneylenders	17	10	6	1	15	2	13	32
Friends and Relatives	25	12	11	2	24	8	16	49
Landlords	—	—	—	—	20	4	16	20
Rural Rich	9	3	4	2	8	3	5	17
Marketing Inter-mediaries	7	2	3	2	5	4	1	12
Shopkeepers	7	4	2	1	5	—	5	12
Others	8	2	5	1	7	2	5	15
Total NIN Sources	**31**	**17**	**12**	**2**	**28**	**10**	**18**	**59**
Government	6	1	3	2	6	3	3	12
ADB	5	—	3	2	—	—	—	5
Co-operatives	13	5	4	4	5	3	2	18
Total IN Sources	**20**	**6**	**8**	**6**	**8**	**4**	**4**	**28**
Total : All Sources	**41**	**18**	**15**	**8**	**32**	**13**	**19**	**73**
Comilla								
Professional Moneylenders	10	8	1	1	6	—	6	16
Friends and Relatives	17	15	1	1	9	2	7	26
Landlords	—	—	—	—	11	1	10	11
Rural Rich	5	4	—	1	2	—	2	7
Marketing Intermediaries	4	3	—	1	—	1	1	5
Shopkeepers	3	2	—	1	1	—	1	4
Others	3	2	1	—	2	—	2	5
Total NIN Sources	**23**	**20**	**2**	**1**	**11**	**2**	**9**	**34**
Government	4	4	—	—	1	—	1	5
ADB	3	—	1	2	—	—	—	3
Co-operatives	16	6	8	2	6	2	4	22
Total IN Sources	**19**	**7**	**9**	**3**	**7**	**2**	**5**	**26**
Total : All Sources	**35**	**22**	**9**	**4**	**16**	**4**	**12**	**51**

TABLE B

NUMBER OF FARMS USING CREDIT FOR DIFFERENT PURPOSE: PHULPUR, COMILLA, 1974/75

	Owner	Small	Medium	Large	**Tenant**	Group I	Group II	All Farms
Phulpur								
Capital Expenditure	**19**	**5**	**9**	**5**	**11**	**6**	**5**	**30**
Agricultural Implements	6	3	2	1	4	2	2	10
Livestock	2	–	1	1	2	1	1	4
Construction	9	2	5	2	3	1	2	12
Land Purchase	2	—	1	1	2	2	—	4
Current Farm Expenses	**19**	**10**	**5**	**5**	**12**	**4**	**12**	**31**
Farm Inputs	14	9	3	2	8	2	6	22
Payment to Labour	5	1	2	3	4	2	2	9
Consumption	**16**	**10**	**6**	—	**10**	**3**	**7**	**26**
Repayment of Old Loans	**9**	**5**	**3**	**1**	**9**	**3**	**6**	**18**
Others	**10**	**44**	**3**	**3**	**7**	**3**	**4**	**17**
Total	**41**	**18**	**15**	**8**	**32**	**13**	**19**	**73**
Comilla								
Capital Expenditure	**14**	**6**	**3**	**5**	**6**	**3**	**3**	**20**
Agricultural Implements	6	2	2	2	2	1	1	8
Livestock	3	1	1	1	1	1	—	4
Construction	4	3	—	1	3	1	2	7
Land Purchase	1	—	—	—	—	—	—	1
Current Farm Expenses	**13**	**5**	**5**	**3**	**6**	**3**	**7**	**19**
Farm Inputs	10	4	4	2	4	2	6	14
Payment to Labour	3	1	1	1	2	1	1	5
Consumption	**18**	**13**	**5**	—	**10**	—	**10**	**28**
Repayment of Old Loans	**10**	**6**	**3**	**1**	**4**	**1**	**3**	**14**
Others	**6**	**2**	**3**	**1**	**4**	**1**	**3**	**10**
Total	**35**	**22**	**9**	**4**	**16**	**4**	**12**	**51**

Unemployment and Underemployment in Bangladesh Agriculture : A Micro Study*

by

M. MASUM**

An attempt is made in this paper to analyse the structure of unemployment and underemployment in Bangladesh agriculture on the basis of a micro study. In particular, the study tries to relate the degree of underutilisation of labour with farm size on the one hand and tenurial status on the other. In view of extreme periodicity in agricultural activities, the degree of unemployment is estimated with reference to three-time periods—whole year, busiest season and busiest period. Defining withdrawable surplus of labour as the level of unemployment in the busiest period, it appears that roughly 20 per cent of the labour force can be withdrawn without adversely affecting the level of output, although only about 6 per cent of the labour force is employed throughout the year. As for the structure of unemployment, it is revealed that the share-croppers is significantly better than that of the owner operators, and that the largest farm size class shelters the highest proportion of surplus labour for the whole year.

I. INTRODUCTION

Most of the existing studies on the incidence of unemployment and underemployment in Bangladesh agriculture use an aggregative framework of analysis [4 ; 5 ; 6]. The principal concern of most of those studies is with estimation of unemployment and surplus labour at the aggregate level. In the present study, we shall try to go somewhat deeper into this issue and analyse the structure of unemployment and underemployment, in addition to estimating the aggregate magnitudes. In particular, we shall try

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*This paper is a revised version of a chapter of the author's unpublished Ph. D. dissertation [2].

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to relate the magnitude of underutilisation of labour with farm size on the one hand and tenurial status on the other. This will enable us to identify the groups of people in rural Bangladesh whose labour is most underutilised. Adequate information along these lines would be an essential input in any well-designed programme for employment expansion and poverty eradication. Keeping the latter objective in mind, we have also tried in this study to relate employment level with income earning for different categories of agricultural population.

The methodology of estimating underemployment is explained in Section II. The results are analysed in Section III. An aggregate estimate of surplus labour is provided in Section IV where we also make the important distinction between surplus labourers and surplus labour time. The income aspect of underemployment is explored in Section V, while Section VI summarises the findings.

The farm management study on Phulpur Thana conducted by the Bangladesh Institute of Development Studies forms our data base.[1] A major limitation of our study is that the nature of our data constrained us to confine our study to the landed peasant families only (i. e., families having an operational holding ; ownership is not a necessary condition). Our study, therefore, cannot throw any light on the employment situation of landless agricultural labourers on whom falls the major incidence of unemployment.

It should also be mentioned that throughout this paper we have used two broad assumptions about division of labour and income within a family farm. These are : i) all work in the family farm is equally shared by all the members of the labour force[2] belonging to that farm, and ii) all income generated in the farm and outside is also equally shared by all the members of the labour force in that farm.

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[1]The reference period for this Survey is the crop-year 1969/70. Two hundred farms were selected at random, but of them only 152 farm families could be interviewed. Four years after completion of the Survey, the Institute has provided me with detailed data of 127 farms

[2]All adult males (age 12 and above) excepting students are defined to belong to labour force. The reason for excluding females from the labour force is that due to the traditional religious values prevalent in Phulpur thana, female participation in outdoor agricultural activities was found to be extremely negligible. It is, however, observed that in some of the post-harvest operations generally done within the household, participation of female labour is pretty high. Such operations, however, account for only negligible proportion of the total mandays used in the whole process of crop-production.

One can certainly question the validity of the above assumptions. But the available data give us mandays employed in the family farm in aggregated figures only. And same is the case with income too. As such we have no other alternative but to make these broad assumptions.

II. METHODOLOGY OF ESTIMATING UNDEREMPLOYMENT

Throughout this paper we define un- and underemployment according to the time criterion. A person is 'employed' (meaning fully employed) if the utilisation of his labour time does not fall short of a minimum norm. Shortfall of actual labour time utilised from the 'norm' measures the degree of one's underemployment.

In view of extreme seasonality in Bangladesh agriculture, and variation in labour requirement at different stages of production within the same season, we define the rate of unemployment in relation to three different reference periods—whole year, busiest season and busiest period.

Unemployment Estimate for the Whole Year

The full employment norm for the whole year is taken to be 300 mandays per person. The total of all mandays of a household's family labour utilised on the production of all crops in the year, was divided by the agricultural labour force belonging to that household to get for each member the number of days employed in one's own farm. Family farm, however, is not the only source of employment. In the absence of direct information regarding the number of days employed outside we estimate the same under certain simplifying assumptions.

We assume that wage income of a household, picked up from the data on non-farm income, divided by the average agricultural wage rate gives us the number of days of employment outside.[3] The assumption of equal work sharing is now extended to employment outside as well to get per capita figures.

By adding days employed in the family farm and days employed outside, we get our requisite figure on total employed days for each labourer in each household for the whole year. Comparing the same with our full employment norm of 300 mandays per year we classify a person as 'employed' or 'underemployed'.

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[3]Data reveals that there exists seasonal variation in agricultural wage rates. So, instead of using yearly averages, we have used the seasonal averages in working out the number of days employed outside one's farm for each season.

7—

Unemployment Estimates for the Busiest Season

Agriculture is a seasonal activity. A few crop seasons comprise the whole year and the seasons vary in importance with respect to the production and employment they generate. It would thus be of great interest to study the problem of unemployment as it is distributed over the different crop seasons, so as to be able to identify the season where the incidence of unemployment is the severest and where it is the least.

We define the busiest season as one which offers the maximum employment. There does not, however, exist any unique 'Busiest Season'. It may vary from farm to farm depending principally on its cropping pattern.

A person may be underemployed for the whole year, but fully employed in a particular season. The estimation procedure is exactly the same. As our purpose is to throw light on the distribution of employment over different seasons, we define an equal full employment norm, 100 mandays per person per season for all the three seasons—*Aus*, *Aman* and *Boro*. For estimating the number of days employed only minor modifications are necessary. Instead of considering mandays used in all crops produced throughout the year, only those used in the production in a particular season are considered. Similarly, to determine the number of employed days outside, only the wage income of that particular season is considered.

If a person is found fully employed in any of the seasons, we call him 'employed in the busiest season'.

Unemployment Estimates for the Busiest Period

If sporadicity of employment is to be taken into account fully, then looking at the distribution of employment between the seasons would not be enough. For even within each season there are a number of peaks and slacks of labour demand for every crop, i.e., mandays are not uniformly distributed over the whole season. The traditional approach in this respect has been to focus on the principal crop and only its peak labour demand during the harvesting time. But such an approach overlooks many important facts. The harvesting time need not necessarily be the only peak. Depending on various factors, even 'land preparation' and 'sowing and transplanting' periods may turn out to be high peaks if the labour demand for these operations are concentrated over a very narrow time period.

The problem is further complicated by the fact that different agricultural processes of one crop clash with others and it may occur also over different seasons.

We have worked out the employment distribution of every individual labourer over as many as eight 'peaks'. The procedure is quite simple. We have disaggregated the total mandays utilized in the production of each crop over three different agricultural operations : 'land preparation', 'sowing/transplanting and interculture' and 'harvesting'. Considering how different operations of different crops clash over time, we suitably adjust our 'peaks' and figures of mandays utilized in those peaks.[4] Comparing the two, we find out the employment status of an individual labourer over eight different 'peaks'.

On the basis of the employment status in the highest peak, which may be different for different labourers, we determine the employment status of an agricultural labourer in the 'Busiest Period'. If some one is found to be fully employed in any of the peaks, we call him 'employed in the busiest period'.

We have left out the number of mandays employed outside one's own farm in calculating the labour days utilized in the busiest period. We have been forced into this omission by lack of data, but we do not feel that this will introduce a great deal of inaccuracy because, in general, an agricultural labourer works mostly on his own farm during the busiest period.

III. STRUCTURE OF EMPLOYMENT IN BANGLADESH AGRICULTURE

The conventional approach has been to investigate the employment status of the labourers for the whole year. Let us begin with that.

Table I reveals that only a small proportion of total agricultural labour force is fully employed for the whole year. The employment level, however, varies with farm size—the larger the farm size, the larger is the number employed in both absolute as well as percentage terms. But even in the highest farm size group, the percentage of labourers employed seems to remain extremely low at 16.

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[4]For a detailed discussion on these 'peaks' and the adjustments entailed by them, see [2].

TABLE I

EMPLOYMENT STATUS FOR THE WHOLE YEAR AND VARIATION ACROSS FARM SIZE

Size of Holding (in acres)	Employed		Unemployed and Underemployed		Total	
	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force
Less than 2.5	1	1	34	54	35	55
	(2.86)	(1.82)	(97.14)	(98.18)		
2.5-4.0	1	1	31	61	32	62
	(3.12)	(1 61)	(96.88)	(98.39)		
4.0-7.5	2	5	37	95	39	00
	(5.13)	(5.00)	(94.87)	(95.00)	14	49
7.5 & Above	2	8	12	41		
	(14.29)	(16.33)	(85.71)	(83.67)		
Total	**6** (5.0)	**15** (5 64)	**114** (95.00)	**251** (94.36)	**120**	**266**

Note : Figures in parentheses are percentages.

A household is defined to be 'employed' or 'unemployed', when all the labourers belonging to that household are 'employed' or 'unemployed'.

Looking more deeply at the level of underemployment (Table II), we find that the largest number of labourers (43%) have an employment level between 100 to 200 mandays and as many as 78% of the total agricultural labour force are employed for less than 200 mandays per year. Labourers with employment for less than 100 days also form a major proportion (35%).

TABLE II

DISTRIBUTION OF AGRICULTURAL LABOUR FORCE ACCORDING TO EMPLOYMENT LEVEL

(mandays, employed)

Less than 100 Days		100—200		200—300		300 & Above		Total	
House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force
42	93	57	115	15	43	6	15	120	266
(35.00)	(34.96)	(47.50)	(43.23)	(12.50)	(16.17)	(5.00)	(5.64)	(100)	(100)

A person not fully employed throughout the year may however be fully employed in the 'busiest season'. Table III presents our findings on the employment status of agricultural labourers in the busiest season. It gives estimates of 'employed' and 'underemployed' for all the labourers, and also of the variation of employment across farm size and tenurial patterns.

In the busiest season, 31% of the total agricultural labour force is found to be 'employed'. This estimate is significantly higher than that for the whole year. The implication is obvious. Employment is unevenly distributed over the different seasons ; and in particular seasons, depending on the crop mix, there is a high concentration of labour use.

A few more generalizations can be made. Employment increases with increase in farm size. We find that the percentage of 'employed' goes up steadily from 18 in size class 'less than 2.5 acres' to 51 in the highest size class '7.5 acres & above'. The pattern conforms to that given earlier by unemployment estimates for the whole year across farm size classes.

One interesting result crops up. Excepting in the smallest size class, share-croppers seem to enjoy better employment position *vis-a-vis* owner operators.[5] In aggregate terms, 38% of the share-croppers are employed as against 29% amongst owner operators. The differences are significant in size classes 2.5 to 4.0 acres and 4.0 to 7.5 acres, where we find that the percentage of share-croppers employed are as high as 47 and 44, whereas the corresponding figures for the owner operators are only 20% and 27%. For whatever it is worth, this result seems to contradict some of the existing notions regarding the 'inefficiency' of share-cropping in terms of input use including labour.

Next we study the employment status of the agricultural labourers in the busiest period, which we have defined in our earlier discussion on methodology. This investigation is important specially for the estimation of surplus labour, for in order to have some idea regarding the volume of withdrawable surplus manpower from agriculture we must know whether at any particular period of time, however short, a person's services are indispensable for maintaining the existing labour input (and output).

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[5]The result, however, stands on a weak footing as the number of observations for share-croppers in different size classes are too few.

TABLE III

EMPLOYMENT STATUS IN THE BUSIEST SEASON : VARIATION OVER FARM SIZE AND TENURIAL PATTERNS

Size of Holding (in acres)	Employed		Underemployed		Total	
	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force
Less than 2.5	**7**	**10**	**28**	**45**	**35**	**55**
	(20.00)	**(18.18)**	**(80.00)**	**(81.82)**	**(100)**	**(100)**
Owner Operators O. O.	6	9	23	37	29	46
	(20.69)	(19.57)	(79.31)	(80.43)	(100)	(100)
Share Croppers (S.C.)	1	1	5	8	6	9
	(16.67)	(11.11)	(83.33)	(88.89)	(100)	(100)
2.5—4.0	**9**	**17**	**23**	**45**	**32**	**62**
	(28.13)	**(27.42)**	**(71.87)**	**(72.58)**	**(100)**	**(100)**
O. O.	5	9	17	36	22	45
	(22.73)	(20.00)	(77.27)	(80.00)	(100)	(100)
S. C.	4	8	6	9	10	17
	(40.00)	(47.06)	(60.00)	(52.94)	(100)	(100)
4.5—7.5	**12**	**30**	**27**	**70**	**39**	**100**
	(30.77)	**(30.00)**	**(69.23)**	**(70.00)**	**(100)**	**(100)**
O.O.	9	23	24	61	33	84
	(27.27)	(27.38)	(72.73)	(72.62)	(100)	(100)
S. C.	3	7	3	9	6	16
	(50.00)	(43.75)	(50.00)	(56.25)	(100)	(100)
7.5 & Above	**6**	**25**	**8**	**24**	**14**	**49**
	(42.86)	**(51.02)**	**(57.4)**	**(48.98)**	**(100)**	**(100)**
O. O.	6	25	8	24	14	49
	(42.86)	(51.02)	(57.14)	(48.98)	(100)	(100)
S. C.	0	0	0	0	0	0
All Farms	**34**	**82**	**86**	**184**	**120**	**266**
	(28.33)	**(30.83)**	**(71.67)**	**(69.17)**	**(100)**	**(100)**
O. O.	26	66	72	158	98	224
	(26.53)	(29.46)	(73.47)	(70.54)	(100)	(100)
S. C.	8	16	14	26	22	42
	(36.36)	(38.09)	(63.64)	(61.91)	(100)	(100)

Table IV presents our findings on the employment status of all agricultural labourers during the busiest period. It also captures the variation of employment across farm size classes and across tenurial patterns.

TABLE IV

EMPLOYMENT STATUS IN THE BUSIEST PERIOD:
VARIATION OVER FARM SIZE AND TENURIAL PATTERNS

Size of Holding (in acres)	Employed		Underemployed		Total	
	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force
Less than 2.5	**27**	**38**	**8**	**17**	**35**	**55**
	(77.15)	**(69.09)**	**(22.85)**	**(30.91)**		
O. O.	23	32	6	14	29	46
	(79.31)	(69.57)	(20.69)	(30.43)		
S. C.	4	6	2	3	6	9
	(66.67)	(66.67)	(33.33)	(33.33)		
2.5—4.0	**28**	**50**	**4**	**12**	**32**	**62**
	(87.50)	**(80.65)**	**(12.50)**	**(19.35)**		
O. O.	19	35	3	10	22	45
	(86.36)	(77.78)	(13.64)	(22.22)		
S. C.	9	15	1	2	10	17
	(90.00)	(88.24)	(10.00)	(11.76)		
4.0—7.5	**33**	**85**	**6**	**15**	**39**	**100**
	(84.62)	**(85.00)**	**(15.38)**	**(15.00)**		
O. O.	27	69	6	15	33	84
	(81.82)	(82.14)	(18.18)	(17.86)		
S. C.	6	16	0	0	6	16
	(100.00)	(100.00)				
7.5 & Above	**11**	**38**	**3**	**11**	**14**	**49**
	(78.57)	**(77.55)**	**(21.43)**	**(22.45)**		
O. O.	11	38	3	11	14	49
	(78.57)	(77.55)	(21.43)	(22.45)		
S. C.	0	0	0	0	0	0
All Farms	**99**	**211**	**21**	**55**	**720**	**266**
	(82.50)	**(79.32)**	**(17.50)**	**(20.68)**		
O. O.	80	174	18	50	98	224
	(81.63)	(77.68)	(18.37)	(22.32)		
S. C.	19	37	3	5	22	42
	(86.36)	(88.09)	(13.64)	(11.91)		

In the busiest period, 79% of the entire labour force is recorded to be 'employed'. This, in fact, is an extremely high employment figure especially when we compare it with figures like 6% and 39%—the employment estimates for the whole year and for the busiest season, respectively. This only reflects the extreme sporadicity of employment in the agricultural sector and focuses on the 'indispensibility' of most of the labourers, for maintaining the existing level of labour use (and output) even though for major part of the year, they may have nothing much to do, either in family farm or outside.

We also observe from Table IV that employment in the 'busiest period' varies across farm size but, this variation is nominal compared to those observed earlier with respect to 'employed' during the whole year and during the busiest season. Labour force belonging to the middle farms enjoy the highest employment status as against large farmers in earlier estimates.

Here also share-croppers are found to be better employed *vis-a-vis* owner operators. When all farms are considered, the percentage of share-croppers 'employed' stands at 88 as against 78% for owner operators. The only size class in which an exception to this rule is observed is the smallest size class, with less than 2.5 acres.

To investigate the employment pattern of agricultural labourers more intensively, we now propose to decompose them into various homogeneous groups, and apply the above three criteria, and see, whether the estimates vary over different groups.

We classify our farms and labour force on the basis of income earned from different sources.

Set A : Farms and labour force with no income other than that generated by the farm.

This implies that agriculture is the only occupation of these labourers and family farm is the only source of employment for them.

Set B : Farms and labourers with non-farm income but no wage income. For these labourers family farm is the only source of employment but there exist other sources of income besides that generated by the family farm.

Set C : Combination of sets A and B. Family farm is the only source of employment but not necessarily of income.

Set D : Farms and labourers with wage income.
The labourers in this group work not only in the family farms, but also in others' farms or in other sectors. They may or may not have other income excepting that generated by the family farm and outside wage employment.

Set A is the most dominant single group in the entire agricultural labour force, comprising 134, out of a total of 266 labourers.

TABLE V

DISTRIBUTION OF EMPLOYMENT OF AGRICULTURAL LABOURERS ACROSS FARM SIZE AND TENURIAL PATTERNS
Set A

Size of Holding (in acres)	Employment during the Busiest Period						Employment* during the Busiest Season	
	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force
Less than	14	18	3	5	17	23	3	5
2.5	(82.35)	(78.26)	(17.65)	(21.74)			(17.65)	(21.74)
O.O	12	16	2	4	14	20	3	5
	(85.71)	(80.00)	(14.29)	(20.00)			(21.43)	(25.00)
S.C.	2	2	1	1	3	3	0	0
	(66.67)	(66.67)	(33.33)	(33.33)				
2.5 <4.0	17	28	2	7	19	35	4	7
	(89.47)	(80.00)	(10.53)	(20.00)			(21.05)	(20.00)
O.O	14	24	2	7	16	31	3	5
	(87.50)	(77.42)	(12.50)	(22.58)			(18 75)	(16.13)
S.C.	3	4	0	0	3	4	1	2
	(100.00)	(100.00)					(33.33)	(50.00)
4.0 <7.5	18	42	2	4	20	46	7	16
	(90.00)	(91.30)	(10.00)	(8.70)			(35.00)	(34.78)
O.O	16	38	2	4	18	42	6	13
	(88.89)	(90.48)	(11.11)	(9.52)			(33.33)	(30.95)
S.C.	2	4	0	0	2	4	1	3
	(100.00)	(100.00)					(50 00)	(75.00)
7 5 & Above	8	30	0	0	8	30	5	23
	(100.00)	(100.00)					(62.50)	(76.67)
O.O	8	30	0	0	8	30	5	23
	(100.00)	(100.00)					(62.50)	(76.67)
S.C.	0	0	0	0	0	0	0	0
All Farms	57	118	7	16	64	134	19	51
	(89.06)	(88.06)	(10.94)	(11.94)			(29.69)	(38.06)
O.O	50	108	6	15	56	123	17	46
	(89.29)	(87.80)	(10.71)	(12.20)			(30.36)	(37.40)
S.C.	7	10	1	1	8	11	2	5
	(87.50)	(90.91)	(12.50)	(9.09)			(25.00)	(45.45)

*We give figures only for the 'employed'. Subtracting that from the total, the figure for 'underemployed. can be obtained.

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TABLE VI

DISTRIBUTION OF EMPLOYMENT ACROSS FARM SIZE AND TENURIAL PATTERNS

Set B

Size of Holding (in acres)	Employment Status in the Busiest Period				Employment Status in Busiest Season			
	Employed		Underemployed		Total		Employed	
	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Less than 2.5	3	5	1	1	4	6	1	1
	(75.00)	(83.33)	(25.00)	(16.67)			(25.00)	(16.67)
O.O	3	5	1	1	4	6	1	1
	(75.00)	(83.33)	(25.00)	(16.67)			(25.00)	(16.67)
S.C.	0	0	0	0	0	0	0	0
2.5∠4.0	5	8	0	0	5	8	2	4
	(100.00)	(100.00)					(40.00)	(50.00)
O.O	3	6	0	0	3	6	2	4
	(100.00)	(100.00)					(66.67)	(66.67)
S.C.	2	2	0	0	2	2	0	0
	(100.00)	(100.00)						
4.0∠7.5	9	23	2	5	11	28	5	14
	(81.82)	(82.14)	(18.18)	(17.86)			(45.45)	(50 00)
O.O	7	19	2	5	9	24	3	10
	(77.78)	(79.17)	(22.22)	(20.83)			(33.33)	(41.67)
S.C.	2	4	0	0	2	4	2	4
	(100.00)	(100.00)	(100.00)	(100.00)			(100.00)	(100.00)
7.5 & Above	2	6	1	4	3	10	0	0
	(66.67)	(60.00)	(33.33)	(40.00)				
O.O	2	6	1	4	3	10	0	0
	(66.67)	(60.00)	(33.33)	(40.00)				
S.C.	0	0	0	0	0	0	0	0
All Farms	19	42	4	10	23	52	8	19
	(82.61)	(80.77)	(17.39)	(19.23)			(34.78)	(36.54)
O.O	15	36	4	10	19	46	6	15
	(78.95)	(78.26)	(21.05)	(21.74)			(31.58)	(32.61)
S.C.	4	6	0	0	4	6	2	4
	(100.00)	(100.00)					(50.00)	(66.67)

TABLE VII

DISTRIBUTION OF EMPLOYMENT ACROSS FARM SIZE AND TENURIAL PATTERNS

Set C

Size of Holding (in acres)	Employment Status during the Busiest Period						Employment Status during the Busiest Season	
	Employed		Underemployed		Total			
	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force
Less than 2.5	17	23	4	6	21	29	4	6
	(80.95)	(79.31)	(19.05)	(20.69)			(19.05)	(20.69)
O.O.	15	21	3	5	18	26	4	6
	(83.33)	(80.77)	(16.67)	(19.23)			(22.22)	(23.08)
S.C.	2	2	1	1	3	3	0	0
	(66.67)	(66.67)	(33.33)	(33.33)				
2.5 ∠4.0	22	36	2	7	24	43	6	11
	(91.67)	(83.72)	(8.33)	(16.28)			(25.00)	(25.58)
O.O.	17	30	2	7	19	37	5	9
	(89.47)	(81.08)	(10.53)	(18.92)			(26.32)	(24.32)
S.C.	5	6	0	0	5	6	1	2
	(100.00)	(100.00)					(20.00)	(33.33)
4.0 ∠7.5	27	65	4	9	31	74	12	30
	(87.09)	(87.84)	(12.91)	(12.16)			(38.71)	(40.54)
O.O.	23	57	4	9	27	66	9	23
	(85.19)	(86.36)	(14.81)	(13.64)			(33.33)	(34.85)
S.C.	4	8	0	0	4	8	3	7
	(100.00)	(100.00)					(75.00)	(87.50)
7.5 & Above	10	36	1	4	11	40	5	23
	(90.91)	(90.00)	(9.09)	(10.00)			(45.45)	(57.50)
0.0	10	36	1	4	11	40	5	23
	(90.91)	(90.00)	(9.09)	(10.00)			(45.45)	57.50)
S.C	0	0	0	0	0	0	0	0
All Farms	76	160	11	26	87	186	27	70
	(87 36)	(86.22)	(12.64)	(13.78)			(31.03)	(37.63)
0.0.	65	144	10	25	75	169	23	61
	(86.67)	(35.21)	(13.33)	(14,79)			(30.67)	(36.09)
S.C.	11	16	1	1	12	17	4	9
	(91.67)	(94.12)	(8.33)	(5.00)			(33.33)	(52.94)

TABLE VIII

DISTRIBUTION OF EMPLOYMENT ACROSS FARM SIZE AND TENURIAL PATTERNS
Set D

Size of Holding (in acres)	Employment Status in the Busiest Period						Employment Status during the Busiest Season	
	Employed		Underemployed		Total			
	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force
Less than 2.5	10	15	4	11	14	26	3	4
	(71.43)	(57.69)	(28.57)	(42.31)			(21.43)	(15.38)
O.O.	8	11	3	9	11	20	2	3
	(72.73)	(55.00)	(27.27)	(45.00)			(18.18)	(15.00)
S.C.	2	4	1	2	3	6	1	1
	(66.67)	(66.67)	(33.33)	(33.33)			(33.33)	(16.67)
2.5 ∠4.0	6	14	2	5	8	19	3	6
	(75.00)	(73.68)	(25.00)	(26.32)			(37.50)	(31.58)
O.O.	2	5	1	3	3	8	0	0
	(66.67)	(62.50)	(33.33)	(37.50)				
S.C.	4	9	1	2	5	11	3	6
	(80.00)	(81.82)	(20.00)	(18.18)			(60.00)	(54.55)
4.0 ∠7.5	6	20	2	6	8	26	0	0
	(75.00)	(76.92)	(25.00)	(23.08)				
O.O.	4	12	2	6	6	18	0	0
	(66.67)	(66.67)	(33.33)	(33.33)				
S.C.	2	8	0	0	2	8	0	0
	(100.00)	(100.00)						
7.5 & Above	1	2	2	7	3	9	1	2
	(33.33)	(22.22)	(66.67)	(77.78)			(33.33)	(22.22)
O.O.	1	2	2	7	3	9	1	2
	(33.33)	(22.22)	(66.67)	(77.78)			(33.33)	(22.22)
S.C.	0	0	0	0	0	0	0	0
All Farms	23	51	10	29	33	80	7	12
	(69.70)	(63.75)	(30.30)	(36.25)			(21.21)	(15.00)
O.O.	15	30	8	25	23	55	3	5
	(65.22)	(54.55)	(34.78)	(45.45)			(13.04)	(9.09)
S.C.	8	21	2	4	10	25	4	7
	(80.00)	(84.00)	(20.00)	(16.00)			(40.00)	(28.00)

In the 'busiest season', it is found that 38% of the total labour force belonging to this set are 'employed' as against 31% for all the sets combined together (Table V). The variation of employment over farm size follows exactly the same pattern as that of 'all farms'. Same is true about variation over tenurial patterns as well.

A similar pattern is observed also in the 'busiest period' when 88% of the total labour force belonging to this set is 'employed' as against 79% for all the sets combined. The variation across farm size and tenurial pattern is exactly similar.

In analysing the employment status of Set B in the 'busiest season', we come across an interesting result. Although the employment level increases with farm size, it increases only upto 7.5 acres and then drastically falls (Table VI). This information gives us an important insight. The rentier class (with non-wage income) amongst agricultural labourers belonging to the largest farm size class, are found to remain underemployed. This underemployment may be voluntary. When there exist other sources of income some of the agricultural labourers may refuse to work after a certain level, depending on their work-leisure preference configuration.

The employment status of Set C (Table VII) is exactly similar to that of Set A.

Coming now to Set D, we find that only 21% are employed in the 'busiest season'. This is significantly lower than the corresponding figure for all other sets, considered singly, or jointly. Distribution of employment across farm size reveals a pattern similar to that of Set B, presumably for the same reason, namely that labourers included here may have other sources of income. Employment position of the share-croppers is better than that of the owner operators, a pattern observed for other sets as well.

In the 'busiest period' also, we find an exactly similar distribution of the 'employed', across size classes and over tenurial patterns.

IV. A DIRECT ESTIMATE OF SURPLUS LABOUR

We have seen that even though the vast majority of farm labourers in Phulpur suffer from acute underemployment throughout the year, agricultural activity is so sporadic in character that most of them (79%) find themselves fully employed in at least one of the peak periods. As

such, to maintain the existing level of labour input and its time distribution we would have to retain this labour in agriculture and any attempt to remove it, given the technique and organisation of production, would result in a fall in output.

However, not all of those whom we find not 'employed' in the busiest period can be called surplus, as all of them are in fact underemployed by our equal work-sharing assumption. If somehow we can work out the 'unemployed equivalent' of those 'underemployed' we can possibly find out the number of 'removable surplus'. This is what we attempt to do in the present section.

Our estimation procedure has the following steps :

1. Identify the households which have surplus potential. Obviously, surplus may exist only in those households whose labourers remain underemployed throughout the year and in all the peak periods.

2. Define for each of the above households its highest peak period on the basis of information about the length of the period and corresponding work load. We have already argued that there exists no unique peak period for all farms and not all peak periods are uniform in length. Therefore, our reference period, the 'highest peak' would vary from farm to farm.

3. Once we have identified the highest peak period for any agricultural household, we focus on the total workload in terms of total number of days of employment for that household in the same period. We reallocate the work load of the household, which so far has been equally shared by all its working members, in the following fashion. Work is allocated to the first person until he is fully employed during the peak period and only then is work allocated to the second person. The process of reallocation continues and at the end, we are left with surplus labourers, if there be any, on the particular farm.

Following the above direct estimation procedure,[5] we work out the number of surplus labourers whose withdrawal from Phulpur farms will not affect total farm output adversely.

The level of underemployment varies significantly from season to season. Thus even if one's withdrawal for the whole year may affect production adversely, withdrawal for a particular season may not do so. In such circumstances, we can call him surplus for that particular season.

[5]The procedure is similar to that of Ashok Rudra [7], with the difference that while Rudra considers a unique peak period for all farms, we consider the 'highest peak' which may vary from farm to farm.

We, therefore, estimate the seasonal surplus as well, for all farms and for all seasons. In these estimates we consider the highest peak period of the respective seasons rather than the highest peak for the year considered before.

It is generally observed that during the brief spell of the peak period most farmers work for longer hours than usual. We, therefore, make an alternative assumption which allows for 20% increase in work time, in the peak period, over the standard 8-hour man-day.

The resulting estimates are presented in Table IX.

TABLE IX

SURPLUS LABOUR ON PHULPUR FARMS

Size of Holding (in acres)	*Aus* Season		*Aman* Season		*Boro* Season		For the Whole Year		Total Labour
	A	B	A	B	A	B	A	B	
Less than 2.5	9	10	9	10	21	21	3	5	55
	(16.36)	(18.18)	(16.36)	(18.18)	(38.18)	(38.18)	(5.45)	(9.09)	
2.5∠4.0	9	12	1	2	24	26	0	1	62
	(14.52)	(19.35)	(1.61)	(3.22)	(38.71)	(41.94)		(1.61)	
4.0∠7.5	9	11	5	5	32	34	0	0	100
	(9.00)	(11.00)	(5.00)	(5.00)	(32.00)	(34.00)			
7.5 & Above	7	8	4	4	15	17	3	4	49
	(14.29)	(16.33)	(8.16)	(8.16)	(30.61)	(34.69)	(6.12)	(8.16)	
Total	**34**	**41**	**19**	**21**	**92**	**98**	**6**	**10**	**266**
	(12.78)	**(15.41)**	**(7.14)**	**(7.89)**	**(34.59)**	**(36.84)**	**(2.26)**	**(3.76)**	

Notes :

B—Allowing for 20% increase in work time, in peak period, over 8 hour man-day, on the part of retained workers after withdrawal.

A—No such assumption is made.

We observe that surplus for the whole year is insignificant. Quite a substantial number can, however, be withdrawn for particular seasons without affecting output. The largest withdrawal is possible in *Boro* season (35%) ; the least in *Aman*, (only 7%).

The incidence of surplus labour varies across farm size and quite contrary to Shakuntala Mehra's assumption [3], it is the largest farm size class which shelters the largest proportion of surplus labour for the whole year.

We had, however, seen that all agricultural labourers of Set A i.e., 'pure farm workers' belonging to the highest farm size class were found to be fully employed during the busiest period. Surplus in large farms, therefore, exists only in those large farms which belong to Sets B and D, having alternative source of income.

Although the proportion of 'surplus labourers' is quite small, the magnitude of surplus labour time is quite enormous. 'Surplus labour time' is here defined as the difference between total number of man-days available (worked out on the basis of the assumption that each labourer is available to work for 300 days in a year) and total number of man-days employed.

TABLE X

SURPLUS LABOUR TIME FOR THE WHOLE YEAR

Farm Size (in acres)	Size of Labour Force	Days of Employment in Family Farm	Days of Employ-ment Outside	Total Employed Days	Total Available Man-days	Employed Time (%)	Surplus Time (%)
Less than 2.5	55	5658.54	1548.07	7206.61	16500.00	43.68	56.32
2.5-∠4.0	62	8786.49	547.12	9333.61	18600.00	50.18	49.82
4.0-∠7.5	100	14575.49	1010.82	15586.31	30000.00	51.95	48.05
7.5 & Above	49	9177.12	357.30	9534.42	14700.00	64.86	35.14
Total	**266**	**38197.64**	**3463.31**	**41660.95**	**79800.00**	**52.21**	**47.79**

We observe that 47.79% of the total available man-days are surplus and surplus labour time varies inversely with farm size (Table X).

V. RELATIONSHIP BETWEEN EMPLOYMENT AND INCOME

We have so far viewed employment from the angle of time criterion only. We have called a person fully employed if his available labour time is fully utilised. But there are compelling arguments to broaden the perspective and define underemployment with reference to both time and income, specially when discussions on unemployment and underemployment are related to those on poverty and welfare [1 ; 8]. A person fully employed by time criterion can nevertheless earn so little as would be barely sufficient to maintain him at the subsistence level. Ensuring full employment on the

basis of time would not, in these situations, be quite enough as measure against poverty. It would, therefore, be useful to have estimates of underemployment on the basis of income criterion.

In order to be true to the conceptual implication of income criterion, we shall have to decompose total income into several components, each attributable to a particular factor of production, and then relate employment only to that component of income which accured to labour. But some methodological problems and inadequacy of data prevent us from following this procedure. We are thus unable to present any estimate of underemployment according to the income criterion. However, in what follows, we try to relate employment with income in the hope that this will throw some light on the income aspect of employment. At the very least, this will show how adequately or inadequately the degree of employment according to time criterion can capture the income aspect of employment as well.

First, we study all the agricultural labourers, but restrict ourselves to the relation between income and employment as they are generated in the family farms alone.

We observe from Table XI that, there exists a direct relation between employment and income. None amongst those who had worked for 300 days or more, had an annual income (farm income) of less than Tk. 1,000 and the majority of them (53%) earned above Tk. 2,000 per annum.

TABLE XI

EMPLOYMENT AND INCOME

(Income (Takas))

Employment (man-days)	Less than 500		500-∠1000		1000-∠2000		2000 & Above		Total	
	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force
Less than	15	38	14	32	10	18	3	5	42	93
	(35.71)	(40.86)	(33.33)	(34.41)	(23.81)	(19.35)	(7.14)	(5.38)		
100-∠200	15	44	20	41	15	23	7	7	57	115
	(26.32)	(38.26)	(35.09)	(35.65)	(26.32)	(20.00)	(12.28)	(6.09)		
200-∠300	0	0	9	30	6	13	0	0	15	43
			(60.00)	(69.77)	(40.00)	(30.23)				
300 & Above	0	0	0	0	3	7	3	8	6	15
					(50.00)	(46.67)	(50.00)	(53.33)		
Total	**30**	**82**	**43**	**103**	**34**	**61**	**13**	**20**	**120**	**266**
	(25.00)	**(30.83)**	**(35.83)**	**(38.72)**	**(28.33)**	**(22.93)**	**(10.83)**	**(7.52)**		

None amongst those who had worked for 200 to 300 days earned less than Tk. 500. A majority of them (70%) earned in the range between Tk. 500 to 1,000 and a big chunk (30%) earned more than Tk. 1,000.

A similar pattern is observed for those working 100∠200 days and less than 100 days. 73.91% of labourers working for 100 to 200 days fall in the income bracket of less than Tk. 1,000, and 75% of labourers working less than 100 days, fall in the same income bracket.

Although generally more income seems to go with more employment, we have some results which do not conform to this pattern. We find that 5% of the labour force working less than 100 days enjoy an annual income of Tk. 2,000 and above, and hence income and employment are not quite synonymous. Higher employment does not necessarily mean higher income and low employment does not necessarily go with low income.

In Table XI we have shown how income varies with variation in employment. In Table XII we show how employment varies with variation in income. A study of both the tables will help us in a better understanding of the inter-relationship between income and employment.

TABLE XII

INCOME AND EMPLOYMENT

(man-days)

Income (Tk)	Less than 100		100-∠200		200-∠300		300 & Above		Total	
	Household	Labour Force	Household	Labour Force	Household	Labour Force	Household	Labour Force	Household	Labour Force
Less than 500	15 (50.00)	38 (46.34)	15 (50.00)	44 (53.66)	0	0	0	0	30	82
500-∠1000	14 (32.56)	32 (31.07)	20 (46.51)	41 (39.81)	9 (20.93)	30 (29.13)	0	0	43	103
1000-∠2000	10 (29.41)	18 (29.51)	15 (44.12)	23 (37.7)	6 (17.65)	13 (21.31)	3 (8.82)	7 (11.48)	34	61
2000 & Above	3 (23.07)	5 (25.00)	7 (53.85)	7 (35.00)	0	0	3 (23.07)	8 (40.00)	13	20

We find that 40% of those who earn Tk. 2,000 and above per annum, are also employed for more than 300 man-days. A majority of those (59%) who earn between Tk. 1,000 and 2,000 also fall in the medium work category, working between 100 to 300 man-days per year and 64% in the lowest income category also work for the lowest number of days (less than 100 days).

Combining this result with our earlier finding we may conclude that income and employment are inter-related, higher income generally goes with higher employment and higher employment normally generates higher income ; but the existence of exceptions cannot be entirely ruled out.

TABLE XIII

EMPLOYMENT AND INCOME
Set A

Days Employed	Income (Takas)									
	Less than 500		500∠1000		1000∠2000		2000 & Above		Total	
	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force
Less than 100	2 (10.00)	4 (10.81)	10 (50.00)	21 (56.76)	5 (25.00)	7 (18.92)	3 (15.00)	5 (13.51)	20	37
100∠200	6 (20.00)	18 (33.96)	7 (23.33)	14 (26.42)	11 (36.67)	15 (28.30)	6 (20.00)	6 (11.32)	30	53
200∠300	0	0	7 (63.64)	24 (68.57)	4 (36.36)	11 (31.43)	0	0	11	35
300 and Above	0	0	0	0	1 (33.33)	2 (22.22)	2 (66.67)	7 (77.78)	3	9
Total	**8 (12.50)**	**22 (16.42)**	**24 (37.50)**	**59 (44.03)**	**21 (32.81)**	**35 (26.12)**	**11 (17.19)**	**18 (13.43)**	**64**	**134**

TABLE XIV

INCOME AND EMPLOYMENT
Set A

Income (Takas)	Days Employed									
	Less than 100		100∠200		200∠300		300 & Above		Total	
	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force	House-hold	Labour Force
Less than	2 (25.00)	4 (18.18)	6 (75.00)	18 (18.82)	0	0	0	0	8	22
500∠1000	10 (41.67)	21 (35.59)	7 (29.17)	14 (23.73)	7 (29.17)	24 (40.68)	0	0	24	59
1000∠2000	5 (23.81)	7 (20.00)	11 (52.38)	15 (42.86)	4 (19.05)	11 (31.43)	1 (4.76)	2 (5.71)	21	35
2000 and Above	3 (27.27)	5 (27.78)	6 (54.54)	6 (33.33)	0	0	2 (18.18)	7 (38.89)	11	18
Total	**20 (31.25)**	**37 (27.61)**	**30 (46.87)**	**53 (39.55)**	**11 (17.19)**	**35 (26.12)**	**3 (4.69)**	**9 (6.72)**	**64**	**134**

To have a deeper understanding of the relation, we shall now study a homogenous group. Specifically, we shall look into the case of set A, comprising labourers solely dependent on family farms for employment and income, and see whether the pattern of this general relationship remains valid in this specific case as well.

A study of the two Tables XIII & XIV reveal that although 78% of those who work 300 man-days or more per year, earn an annual income of Tk. 2,000 or more, only 39% of those who earn Tk. 2,000 or more, work 300 days or more.

This implies that for Set A, although higher level of employment generates higher income, the reverse is not necessarily true. Higher farm income may be associated with even lower level of employment. This raises an important question. Does it suggest that by proper employment policies we can raise the the income level, whereas income policies may fail to raise employment level ? If so, the approach of looking into employment via income, i. e., the poverty line approach, may turn out to be misleading. It would then be more pertinent to look into the problem of poverty via employment and not the other way round.

VI. SUMMARY OF FINDINGS

The main findings of our study can be summarised as follows :

1. For the whole year, the proportion of all agricultural labour force 'employed' according to the full employment norm of 300 man-days per person per year is extremely low—only 6% in this case. However, the number of 'days employed' are unevenly distributed over different seasons. Slightly less than one-third of all labour force are 'employed' in at least one of the three seasons and about four-fifths of them are 'employed' in at least one of the 'busy periods'.

2. The number of 'employed' increases with increases in farm size, and the employment status of share-croppers is significantly better than that of the owner operators.

3. For the pure family farm workers, i.e., for those having no other source of employment or income except the family farms, the employment position is superior to that of other categories of workers considered singly or jointly, in all the three reference periods. Employment situation seems to be the worst for those workers who have sources of both income and employment outside the family farm.

4. Withdrawable surplus labour for the whole year is insignificant, but quite a substantial number can be withdrawn for particular seasons without affecting output.

5. The incidence of surplus labour varies across farm size and contrary to Shakuntala Mehra's assumption, the largest farm size class shelters the highest proportion of surplus labour for the whole year.

6. There exists a general positive relationship between the number of days worked and the amount of farm income received.

7. For the category of 'pure family farm workers' it has been observed that although a high proportion of the best employed persons falls in the highest income class, the converse is not true.

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The Determinants of Change in Trade Balance: Some Estimates for Bangladesh, 1959/60-1974/75

by

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Changes in the trade balance of Bangladesh are analysed in this paper with the help of a theoretical framework which helps to decompose the change into price and quantity effects. The analysis is conducted in two parts pertaining to the two periods 1959/60 to 1968/69 and 1972/73 to 1974/75. It is shown that trade balance suffered adverse movement in both periods; however, in the earlier period favourable price effect substantially reduced the impact of adverse quantity changes, whereas in the latter period both price and quantity effects were unfavourable and they reinforced each other in creating adverse balance of trade.

I. INTRODUCTION

The problem of balance of trade of Third World countries is well-known. Typically, they incur huge trade deficits annually. The trade balance changes from year to year. A change in output value is the result of the underlying change in price or quantity or both. An attempt is made in this paper to identify the determinants of a change in the trade balance in a manner that will lend itself to empirical estimation and then to derive the empirical estimates.

Section II discusses the theoretical framework of our study. Sources of data and some associated problems are discussed in Section III. The study is conducted in two parts pertaining to two periods: 1959/60-1968/69 and 1972/73-1974/75. The results of the first and second periods are presented and discussed in Sections IV-A and IV-B respectively. Policy implications are discussed in Section V. and Section VI contains the summary and conclusion.

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II. THEORETICAL FRAMEWORK FOR ANALYSIS

The literature in this area abounds in mathematical expression for the estimation of the 'terms of trade effect' i.e., the effect of relative price changes (of exports and imports) on the trade balance [6]. There is also the gross-barter terms of trade effect which measures the impact of quantity changes on the trade balance. These two are usually presented as isolated effects. This is a result of particular research interests and emphasis.

Such presentation, however, obscures inter-relation of the two effects. Both these effects can be derived from a change in the trade balance between year t and t+j. Thus an integrated picture emerges from the derivation in this paper. Following is the simple analytics of a change in the trade balance :

Let $B_t = P^x_t Q^x_t - P^m_t Q^m_t$, be the trade balance in year t.[1]

where, x denotes exports

m denotes imports

P = Price

Q = Quantity

and t is the time subscript.

Now consider a change in B between years t and t+j,

$$\triangle B = B_{t+j} - B_t$$

$$= \left[P^x_{t+j}\, Q^x_{t+j} - P^m_{t+j}\, Q^m_{t+j} \right] - \left[P^x_t\, Q^x_t - P^m_t\, Q^m_t \right].$$

$$= \left[P^x_t + \triangle P^x \right] \left[Q^x_t + \triangle Q^x \right] - \left[P^m_t + \triangle P^m \right] \left[Q^m_t + \triangle Q^m \right] - \left[P^x_t Q^x_t - P^m_t Q^m_t \right]$$

$$= P^x_t \cdot \triangle Q^x + \triangle P^x Q^x_t - \triangle Q^m P^m_t - \triangle P^m Q^m_t + \triangle P^x . \triangle Q^x - \triangle P^m . \triangle Q^m$$

Rearranging terms, we have :

$$\triangle B = \triangle P^x . Q^x_t - \triangle P^m . Q^m_t + P^x_t . \triangle Q^x - P^m_t . \triangle Q^m + \triangle P^x . \triangle Q^x - \triangle P^m . \triangle Q^m$$

$$= \alpha + \beta + \gamma$$

[1]More precisely $B_t = \sum_{t=1} P^x_{it}\, Q^x_{it} - \sum_{l=1} P^m_{lt} Q^m_{lt}$ where i and l denote commodities of export and import. The Σ sign is not used for clarity of exposition.

$$\text{where,}\quad \alpha = \triangle B \Big|_{\triangle Q^{x,m}_{=o}} = \triangle Px\, Q^{x}_{t} - \triangle P^{m} Q^{m}_{t} \tag{1}$$

$$\beta = \triangle B \Big|_{\triangle P^{x,m}_{=o}} = P^{x}_{t} \cdot \triangle Q^{x} - P^{m}_{t} \cdot \triangle Q^{m} \tag{2}$$

$$\gamma = \triangle B \Big|_{P^{x,m}_{t} = 0,\, Q^{x,m}_{t=o}} = \triangle P^{x} \cdot \triangle Q^{x} - \triangle P^{m} \cdot \triangle Q^{m} \tag{3}$$

and $\triangle P = P_{t+j} - P_{t},\ \triangle Q = Q_{t+j} - Q_{t}$.

Thus we have algebrically decomposed a change in B into its underlying price and quantity changes. α is the price effect or the effect of changing prices (between the base and a given year), with quantities held constant. β is the quantity effect or the effect of quantity changes on B, prices held constant. Both α and β are partial equilibrium effects. γ is the residual effect. The main interest of this paper is to focus on the price and quantity effects. Therefore, γ is not computed. Given $\triangle B$, α and β, γ can be immediately computed.

The price effect, α can be re-written as,

$$P^{x}_{t} Q^{x}_{t} \frac{P^{x}_{t+j} Q^{x}_{t}}{P^{x}_{t} Q^{x}_{t}} - P^{m}_{t} Q^{m}_{t} \cdot \frac{P^{m}_{t+j} Q^{m}_{t}}{P^{m}_{t} Q^{m}_{t}} - \left[P^{x}_{t} Q^{x}_{t} - P^{m}_{t} Q^{m}_{t} \right].$$

Ignoring the term in parenthesis and deflating this expression by an import price index (Laspeyre's type), one gets the terms of trade effect :

$$\alpha' = P^{x}_{t} Q^{x}_{t} \frac{\dfrac{P^{x}_{t+j} Q^{x}_{t}}{P^{x}_{t} Q^{x}_{t}}}{\dfrac{P^{m}_{t+j} Q^{m}_{t}}{P^{m}_{t} Q^{m}_{t}}} - P^{m}_{t} Q^{m}_{t} \tag{4}$$

or $\alpha' = P^{x}_{t} Q^{x}_{t} \cdot TP - P^{m}_{t} Q^{m}_{t}$, where TP is the net barter terms of trade.

Consequently α' is nothing but the initial trade balance adjusted for the movement in terms of trade. α' is a different quantity than α, but both measure the impact of relative price changes on the trade balance. α' is also called the net barter terms of trade effect.

Following the definition of net barter terms of trade effect, a gross-barter terms of trade effect can also be worked out as follows :

$$\beta' = P^{x}_{t} Q^{x}_{t} \cdot TQ - P^{m}_{t} Q^{m}_{t} \tag{5}$$

where TQ is the gross barter terms of trade i.e., ratio of export quantity to import quantity.

Thus β' is the base year trade balance corrected for changes in the movement of relative export and import quantities.

III. SOURCES OF DATA AND RELATED PROBLEMS

Most of the data used in this paper were taken from an earlier work [10]. The other data used were quantity index of imports and values of exports and imports, taken from various bulletins of the Central Statistical Office [3] and the Foreign Trade Bulletins [4]. All indices used in the second part of the paper were computed earlier [10], since price and quantity indices pertaining to international trade had not yet been computed by the Bureau of Statistics. All details of index computations are given in the respective sources [3 ; 4 ; 10]. The data on import and export values and trade balance for the second part (Bangladesh period) were obtained directly from the Foreign Trade Wing of the Bureau of Statistics in 1975. At the time these estimates were still very preliminary and subject to some revision. All price indices used in this paper are unit-value indices. Some problems related to the data must be kept in mind. These are :

i) The study had to be conducted in two parts covering two time periods (a) pre-Bangladesh (East Pakistan) and (b) Bangladesh. This was necessary because a continuous series of required data was not available and it was thought unwise to link two separate series on account of the significant changes in the direction of trade in the two periods.

ii) The C.S.O. indices used in this paper have 1954/55 as their base. Now, the base year from which a change in price is measured must be the same as the base year of the index. Otherwise a computational problem arises i.e., the necessary cross-term $\sum_i P_{it+j}Q_{it}$ cannot be derived. The choice of the year of reference, from which to measure changes in the trade balance due to price and quantity movements was defined by this constraint. The absence of index data for 1969/70 on a 1954/55 base, prevented any linking of the two series. Measuring changes from 1954/55 as the base is not a drawback ; on the contrary a longer-term perspective is obtained.

iii) The price (unit-value) indices computed for the Bangladesh period are of the Laspeyre variety. The quantity indices are obtained by dividing the value index into the price index. The method yields a quantity index of the Paasche type, which of course leads to the familiar index number problem. If the foreign trade structure changed significantly over the period under consideration, then this method would entail serious biases [1]. In this paper

the time scale involved was only five years and it entailed practically no change in the trade structure. Thus the results using the quantity indices are not likely to be biased in any significant manner.

iv) The price indices are unit-value indices i.e., values divided into quantities. Unit-values are accurate description of prices only in so far as both trade values and quantities are recorded correctly and the commodity group is reasonably homogeneous. Export unit values reflect jute (raw and goods) prices since the proportion of jute in total exports is extremely high. Import unit values also reflect prices of a small number of import items which are proportionately very large [10]. Export and import prices (of important items) were compared with unit-values used in this study. There was close conformity between the two. Hence the bias in this regard is also likely to be small. Another potential problem here is that if the foreign trade structure changes drastically between time 0 and t, then the required cross-valuation (P_{oqt}) might become meaningless [1]. But for the purpose of this paper, this is not a problem.

IV-A. THE RESULTS [FIRST PERIOD 1959/60-1968/69]

In Section II, the price effect of a change in the trade balance was derived to be :

$$\alpha = P^x Q^x_t - P^m Q^m_t$$

$$= P^x_{t+j} Q^x_t - P^x_t Q^x_t - P^m_{t+j} Q^m_t + P^m_t Q^m_t$$

The empirical method to obtain α was as follows :

$$\alpha = \left[P^x_t Q^x_t \cdot \frac{P^x_{t+j} Q^x_t}{P^x_t Q^x_t} - P^m_t Q^m_t \frac{P^m_{t+j} Q^m_t}{P^m_t Q^m_t} \right] - \left[P^x_t Q^x_t - P^m_t Q^m_t \right]$$

$$\alpha = P^x_t Q^x_t \left[\triangle P^x - 1 \right] - P^m_t Q^m_t \left[\triangle P^m - 1 \right] \qquad (6)$$

Equation (6) is the final estimating equation to measure the price effect. It is simply the difference between the base year (t) and jth year trade balances after the base year trade balance is adjusted for movements in export and import prices between years t and t+j, while quantities are held constant at base year levels. Indeed such question is asked about Laspeepe's price index i.e., how the prices of goods exchanged in the base year have changed (to alter the trade balance in this case) ? However, the

approach taken in this paper is somewhat different in the sense that the change is measured as a difference and not as a ratio. Besides, the purpose here is to capture the impact of the price movement on the trade balance.

The quantity or volume effect was derived in (2) in Section II. The equation for β was as follows :

$$\beta=P_t^xQ_t^x\left(.\triangle Q^x-1\right)-P_t^mQ_t^m\left(.\triangle Q^m-1\right) \tag{7}$$

The purpose of changing the form of both α and β is simply to make estimation γ easier. In either case considerable computational simplicity is achieved by altering the forms to (6) and (7). From (7) it can be seen very clearly that the quantity effect is simply the difference between the trade balance in year t and t+j adjusted for changes in volume of exports and imports while prices are held constant.

The estimates of α and β derived by using (6) and (7)are presented in Table I.

TABLE I

ESTIMATES OF PRICE AND QUANTITY EFFECTS OF A CHANGE IN THE TRADE BALANCE

(000 Rupees*)

Years	Change in Trade Balance**	Price Effect (α)	Quantity Effect (β)
1959/60	12,957	479,446	96,589
1960/61	—166,559	1,111,072	—527,991
1961/62	16,366	762,244	—827,991
1962/63	—180,780	576,365	—575,399
1963/64	—675,733	623,022	—965,683
1964/65	—845,047	822,292	—1,852,874
1965/66	—225,286	749,809	—807,603
1966/67	—403,292	1,122,945	—1,499,312
1967/68	—156,670	847,320	—541,360
1968/69	—692,015	945,624	—951,812

* The currency in this period was Rupees [Rs. 4.75 = US $ 1.00 (approx.)].

** Change in trade balance between given year and base year (t = 1954/55). The value of the trade balance in 1954/55 was Rs. 411.35 ml.

It may be recalled that a change in the trade balance between any two years is the sum of a price effect (α), a quantity effect (β) and a residual effect (γ) which is a combined effect of changes in prices and quantities. This identity must hold theoretically, but is unlikely to hold in case of empirical estimation, firstly, because α, β and γ are partial equilibrium effects [2 ; 6 ; 11] and secondly, because of errors and biases in index number computations.

Quantity and price effects have been offsetting in all years but one. This is clear from Table I. Indeed this was to be expected. The increasing price effect is a result of $P^x_{t+j} \cdot Q^x_t > P^m_{t+j} \cdot Q^m_t$, which in turn is a reflection of the upward movement of the commodity terms of trade of Bangladesh in this period.

The quantity effect (β) is observed to be negative and absolutely greater in years of higher price effects in general. The quantity effects are a reflection of the movements in the gross barter terms of trade (Q^x / Q^m) in this period, in which import quantities moved heavily against Bangladesh. The mean quantity effect is somewhat greater than the mean price effect (Rs. 8.45 million and Rs. 8.04 million respectively, the former being the absolute value). Their respective coefficient of variations are -0.6 and 0.25, indicating that variations in quantities are considerably higher than variations in prices. This raises important questions about the need for quantity restrictions in imports and boosting export quantum.

The impact of relative import and export price movements caused the price and quantity effects reported in Table I. Let us now look at their impact on export and import values.

TABLE II

IMPACT OF RELATIVE PRICE MOVEMENTS ON EXPORT AND IMPORT VALUES

(000 Rupees)

Years	$P^x_{t+j} \cdot Q^x_t - P^x_t Q^x_t$	P^x	$P^m_{t+j} \cdot Q^m_t - P^m_t Q^m_t$	P^m
1	2	3	4	5
1959/60	930,556	128.2	451,090	141.9
1960/61	1,625,180	223 1	514,108	161.5
1961/62	1,252,592	172.2	490,348	154.1
1962/63	1,107,669	152.4	531,304	166.9
1963/64	1,084,039	149.2	461,016	145.0
1964/65	1,293,268	177.8	470,975	148.1
1965/66	1,246,594	171.4	496,785	156.1
1966/67	1,555,462	213.6	432,517	136.1
1967/68	1,282,367	176.3	435,047	136.9
1968/69	1,419,610	195.0	473,985	149.0

$P^x_t \; Q^x_t = 731{,}569$; $P^m_t \; Q^m_t = 320{,}217$; $t = 1954/55$ (base year) ; $j = 5, 6, 7, \ldots 14$.

From Table II it is evident that the commodity terms of trade moved upwards significantly. The impact of export price changes on export values (col. 2) was far greater than the impact of import price movements on import values and hence the behaviour of price effects as in Table I (computed as the difference between col. (2) and col. (4) of Table II). The annual average absolute price variation of export prices was greater than that of import prices (18.6% as against 6.98%). This measure is one of the many measures used to gauge price instability. On the basis of this somewhat "crude" measure, export prices show greater instability than import prices. However, a rigorous test of the 'instability hypothesis' is beyond the scope of this paper.

Table III gives the impact of quantity movements on import and export values.

TABLE III

THE IMPACT OF QUANTITY MOVEMENTS ON EXPORTS AND IMPORT VALUES

(000 Rupees)

Years	$P^x_t Q^x_{t+j} - P^x_t Q^x_t$	Q^x	Percentage Change in Q^x over Previous Year	$P^m_t Q^m_{t+j} - P^m_t Q^m_t$	Q^m	Percentage Change in Q^m over Previous Year
1959/60	879,200	121.18	—	782,610	245.40	—
1960/61	687,163	94.93	—21.66	1,214,967	380.42	+55.02
1961/62	783,437	108.09	+13.86	1,611,428	504.23	+32.54
1962/63	895,806	123.45	+14.21	1,471,205	460.44	—0.09
1963/64	875,981	120.74	— 2.20	1,841,664	576.13	+25.12
1964/65	785,778	108.41	—10.21	2,638,652	825.02	+43.20
1965/66	906,999	124.98	+15.28	1,714,602	536.45	—34.98
1966/67	858,862	118.40	— 5.26	2,358,174	737.43	+37.46
1967/68	831,282	114.63	— 3 18	1,372,642	429.66	—41.73
1968/69	1,015,345	139.79	+21.96	1,967 157	615.32	+43.21

Q^x,Q^m=Quantum index of Exports and Imports respectively ; t = 1954/55 and j=5 ... 14.

The trends that emerge in Table III are on the whole the exact obverse of what was observed for prices in Table II. The adverse movement of the gross barter terms of trade is evident in Table III. The difference between current (t+j) quantities evaluated at base year prices (col. 4) is greater (except for 1959/60) than the same evaluation on the export side (col. 2) and hence the quantity effects as they appear in Table I.

A serious drawback of the results presented in Table I, is that the price and quantity effects are dependent on the magnitude of the trade balance in the arbitrarily chosen base year. The year 1954/55 was a year of relatively large trade surplus (simply a reflection of the even more backward state of the economy, then). Had a different year been chosen as the base, a completely different set of results, compared to Table I could have emerged. In order to increase the credibility of the results obtained, it would be preferable to change the base year at regular intervals and then compute the results given in Table I. More insight could then be gained from a comparison of the alternative estimates based on alternative base years.

The analysis carried out so far can also be approached in a slightly different manner, where the movements of net and gross barter terms of trade are studied directly [6]. In this case, the price and quantity effects cannot be estimated, but it can be established that both price and quantity changes are determinants of changes in trade balance values from year to year.

TABLE IV

THE TRADE BALANCE, NET AND GROSS BARTER TERMS OF TRADE

(1954/55 = 100)

Years	B'	TP	TQ
1959/60	106	90.36	49.38
1960/61	124	139.13	24.95
1961/62	149	111.74	21.44
1962/63	123	91.31	26.81
1963/64	84	102.9	20.96
1964/65	74	120.06	13.14
1965/66	114	109.77	23.30
1966/67	100	156.99	16.10
1967/68	111	128.81	26.68
1968/69	84	130.88	22.72

$B' = X/M$; $TP = P^x/P^m$; $TQ = Q^x/Q^m$

$\frac{X}{M} = \frac{P^x Q^x}{P^m Q^m}$ i. e., ratio of exports to imports equals the net barter times the gross barter terms of trade,

$$d\left(\frac{X}{M}\right) = \underbrace{\frac{Q^x}{Q^m}\, d\left(\frac{P^x}{P^m}\right)}_{\alpha} + \underbrace{\frac{P^x}{P^m}\, d\left(\frac{Q^x}{Q^m}\right)}_{\beta} + \underbrace{d\left(\frac{P^x}{P^m}\right) d\left(\frac{Q^x}{Q^m}\right)}_{\gamma}$$

: This result was derived earlier in discrete terms.

Now the trade balance is expressed as a ratio : X/M rather than the conventional practice (X-M), as has been done so far in this paper. The trade balance expressed as a ratio reflects only the relative price changes in exports and imports. since inflationary effects cancel out. The trade balance ratio (B′), net barter terms of trade (TP) and gross barter terms of trade (TQ) are given in Table IV.

As prices of exports relative to imports rise the quantity of exports relative to imports decline. The counterveiling movements in relative prices and quantities are quite apparent in Table IV. Had this movement not been counterveiling (i. e., underlying demand elasticities were very low) the trade balance ratio would have been far worse. One strong point of this type of analysis may be pointed here. The responsiveness of quantities to changing prices can be understood and this is reflected in the estimates. But in simple demand (export and import) studies, particularly import demand studies for LDC's, it is very difficult to capture this response, because a demand curve requires correct specification of shifters (e. g., income) which in case of LDC's tend to subsume the price-quantity relationship completely at times.

From Table IV a rough approximation of the relative importance of TP and TQ can be attempted. B′ and TQ move in the same direction in six years out of ten, whereas this happens in only two years in case of TP. This is an indication of the dominance of TQ on movements in B′. In 1961/62 both TP and TQ decline while B′ rises—an impossible result. The problem most likely lies in errors in the original datum for this year.

IV-B. THE RESULTS [SECOND PERIOD 1972/73-1974/75]

The time span under consideration in this sub-section is very small so that the results are presented and discussed briefly. The price and quantity effects in this period appear in Table V. The base year is now 1969/70 instead of 1954/55 previously.

TABLE V

ESTIMATES OF PRICE AND QUANTITY EFFECTS OF A CHANGE IN THE TRADE BALANCE

(000 Takas *)

Years	Change in Trade Balance**	Price Effect	Quantity Effect
1972/73	—2,223,136	—622,997	—2,281,620
1973/74	—4,164,236	—4,012,927	—501,462
1974/75	—7,856,636	—4,136,987	—1,565,623

*Taka is the Bangladesh currency : Tk. 8.00 = US $ 1 (till May 1975)
Tk. 15.00 = US $ 1 (from May 1975).

**Change in trade balance between each year (t+j) and the base year 1969/70, j = 3,4,5.

The price and quantity effects for this period have been in the same direction rather than being offsetting as was the case in the earlier period. Thus instead of a countervailing price-quantity effects resulting in a dampened effect on trade balance changes, the reinforcing movements of these variables aggravated these changes. These results imply highly adverse relative price and quantity (of exports and imports) movements, which caused the consistently and significantly negative price-quantity effects [12]. This can be seen in Table VI.

TABLE VI

THE TRADE BALANCE, NET AND GROSS BARTER TERMS OF TRADE

(1969/70 = 100)

Years	B′	TP	TQ
1972/73	52	91	55
1973/74	40	49	91
1974/75	28	54	63

The serious worldwide inflationary spiral in this period resulted in the extremely adverse terms of trade movements. The important thing to remember here is that the "opening" up of the Bangladesh economy to India and the Soviet Union, with whom legal bilateral trade also reached a peak, did not in any way alleviate the crisis in the foreign trade sector.

V. SOME IMPLICATIONS FOR POLICY

The findings of this study rekindles the much celebrated tariff-quota controversy. The theoretical framework within which this controversy is mooted and finally tariffs proclaimed the victor, is the neo-classical free trade regime. It is wellknown that such a regime is a one-sidedly wishful concoction of reality. Policy must be based on practical considerations of national economic interest.

It was found that import quantities moved in a highly adverse manner. This in itself is not a bad sign. What matters is the composition of imports. In the 1960's consumer goods and raw materials for consumer goods claimed the largest share in the import bill, resulting in unproductive consumption [5]. This proved to be a subsidy to the urban upper classes.

This trend continues even after Bangladesh was created. Here the need for quantitative restrictions or quotas on imports cannot be over-emphasized. The funds saved could be diverted to capital goods imports or industrial export subsidies to boost export quantum. The volume of trade must increase and relative quantity movements can even be adverse, but the capacity to import out of domestically generated resources must grow.

Tariffs can serve as sources of revenue aud simultaneously as a means to develop the home market. Thus imposition of Tariffs on imported commodities which compete with the same commodities produced internally or cannot be classified as necessities must assume priority.

Our findings show a great deterioration in the commodity terms of trade between 1969/70 and 1974/75. However, a deterioration or an improvement in the terms of trade does not by itself mean much. Firstly, the underlying changes in productivity must be studied. Secondly, pure price changes (net of inflation) must be observed instead of just nominal prices. Thirdly, prices must be viewed in relation to their true values in order to develop a notion of a "fair" price.

Price instability was yet another discernible problem. Both supply bottlenecks and business cycles in the rest of the world, are sources of price fluctuations. Jute is Bangladesh's major export item, and the export price stabilisation must simply mean jute price stabilisation, until significant diversification takes place. Here there is a case for pressing for an International Commodity Agreement in Jute in line with the proposals of UNCTAD-IV. The "welfare" implications of price stabilisation is a moot issue. Much of the controversy is lost in purely *a priori* theoretical jugglery rather than practical considerations. Some favour price stabilisation [8], while others oppose it [9 ; 13]. Kofi takes a more practical approach and runs a market simulation of the cocoa market, which shows that if the 1968 Draft Agreement on cocoa had been ratified by consumers and producers, the latter would have earned $ 185 more in revenues, net of operating (buffer stocks) costs [7]. Such possibilities for jute must be thoroughly investigated. Export diversification must, however, be the longer run objective. "Longer run" in this context cannot mean more than a decade, since jute is already facing grave competition from high-technology-infused synthetic substitutes. Competition from such substitutes is irreversible in nature, which adds another dimension to the jute problem.

The most alarming finding of our analysis is underlying price and qantity movements which result in the estimated price and quantity effects.

Bangladesh is and has been helpless in the face of adverse price-quantity movements in international trade. A 'favourable' term of trade index might not signify any real resource transfer. Systematic increases in the price of exports along a stable elastic demand curve will reduce revenues. The question of productivity changes is also well known. The results show the country's hopeless dependence on the world market. The situation can be reversed by a trade policy appropriately linked to an overall policy of self-reliance. There is no other way of generating the resources required for rapid economic development.

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Note

Birth Rate and Death Rate in Bangladesh : 1951-74*

by

SHARIFA BEGUM**

I. INTRODUCTION

During the period of 1951-74 a number of estimates for the national level birth and death rate were obtained using either the decennial censuses or sample surveys. All these estimates taken together present a rather confusing picture, because for the same period these estimates tend to disagree quite widely (estimates of crude birth rate for 1951-61 range between 50 and 60 and those for 1961-74 range between 42 and 53). Such divergence is explained by the fact that the various estimates have been obtained under different assumptions, measurement techniques, sampling methods, area and population. Consequently, any intertemporal comparison among these estimates is bound to be devoid of any meaning. The present paper is a modest attempt to overcome this situation.

This paper aims to obtain the crude birth and death rate for Bangladesh for the last two intercensal periods separately i.e., for 1951-61 and 1961-74 periods, using a uniform methodology and the same source of data. This will help us discern any changes in the vital rates between the two periods. In calculating the vital rates, a few alternative methods capable of utilizing incomplete data were used independently. The idea of using various methods is to bring additional evidence to bear on this issue. Section II of the paper describes the inputs in the analysis, Section III explains in brief the methods of estimation and Section IV evaluates the results obtained in the analysis. An explanation of the observed trend in vital rates has been offered in this section.

* A part of this paper was prepared while the author was at the International Institute for Population Studies (IIPS), Bombay, India.

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II. INPUT AND METHODOLOGY

We have used the decennial censuses as our data base in obtaining the estimates for the vital rates under study. It should perhaps be mentioned in this connection that elsewhere we have been very critical about the census performance in Bangladesh [19]. Yet this particular source has been selected for data on two grounds : (a) census in our country is the only source so far that provides demographic data at a certain regular interval and under the same methodology, (b) there are methods in demography which can utilize incomplete census data for such purpose.

In estimating the vital rates the age returns of 1951, 1961 and 1974 censuses have been used. The percentage age, sex distribution of the population of these three censuses is given in Table I. No attempt has been made to smooth these census age returns because some inherent biases may arise in the process of smoothing and also because most of the methods that have been used in the analysis do not require any smoothed age data. However, in order to obtain the natural population at the census time an adjustment has been made to the census population of 1961 and 1974 for net inter-censal migrants and the extra deaths due to the Cyclone of 1970 and the Liberation War of 1971. For the methods that require age data ten years apart, the second intercensal period has been reduced to 1964-74 and an age distribution corresponding to 1964 has been constructed using the following formula :

Formula[1]

$$f(x) = f(a) \frac{(x-b)}{(a-b)} + f(b) \frac{(x-a)}{(b-a)}$$

f (x) = Population at estimate date i.e., 1964

f (a) = Population at starting date i.e., 1961

f (b) = Population at terminal date i.e., 1974

x = Estimate date

a = Starting date

b = Terminal date.

The exponential rate of growth of natural population (r) for 1951-61 period has been worked out from the total population of 1951 census and the migration-adjusted total population of 1961 census. Accepting Channa's [7] and Mitra's [6] estimates (of 3.5 and 3.15 million respec-

[1]A simple growth pattern of the age groups has been assumed here because in the absence of reliable required information the use of a complicated growth pattern would constitute a very minimum improvement over the present one, if at all.

tively) for the net shifting of population from Bangladesh to India during 1951-61, the growth rates for the period stand at 26.07, 25.14 and 25.62 per thousand population for male, female and total population respectively.[2] The growth rate for 1961-74 has been obtained by allowing for 1.5 million net emigrants from the country, 0.5 million deaths for 1970 Cyclone [14], 1.5 million deaths for the Liberation War of 1971 [16] and also by assuming that the sex-ratios of the above groups are identical to those of the census population. The resulting estimates for male, female and total population for the period are respectively 28.93, 28.81 and 28.87 per thousand population.

The entire analysis here is based on only one sex, the female population, in the sense that vital rates are first estimated for the female population wherefrom the estimates for the total population are computed from the formula :

$$\text{Total birth rate} = \text{female birth rate} \times \frac{1 + \text{sex - ratio at birth}}{1 + \text{sex - ratio of the population.}}$$

The sex-ratio at birth is assumed to be 106 [17] for both the periods ; and the sex-ratio for the natural population is taken to be 110.7 (after adjustment for the migrants) for 1961 and 108 [14] for 1974.

As the unsmoothed census age date are preferred in the analysis, it would perhaps be appropriate to mention here some features of the census age returns that have been used. Many demographers have noticed excessive recording 0-9 age group in 1961 census [3 ; 11]. Such overreporting was particularly severe for the age group 5-9 and this has been done, deliberately according to some allegations, at the cost of mainly the age group 10-19. The Census authority, however, made an effort to defend this unusual age returns of 1961 [10], but their argument has failed to satisfy the users.

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[2]Two other estimates are available for net volume of population movement during 1951-61—1.15 ml. and 1.24 ml. provided by Khan [15] and Visaria [22] respectively. However, these estimates tend to produce higher growth rate for female (22.4 per thousand) than for male (20.6), which is against the observed sex-differential mortality pattern of that time (when females were found to have higher mortality than males [1 ; 23]. We, therefore, decided to reject these estimates in our analysis.

However, no such charge of deliberate misreporting has yet been made against the 1974 census with respect to any particular age group or the age return as a whole. It is, therefore, assumed here that the recorded age data of 1974 census has incurred only those errors that are common to any census of a developing country, and as such no special attention has been devoted to it in the analysis.

III. METHODS OF ESTIMATION

It has been mentioned already that the size of the 0-9 age group of 1961 census is over enumerated to a noticeable extent. We have tried to take care of this problem by using only those methods for 1951-61 which utilize a large proportion of the population in the estimation process and would be least responsive to the observed overenumeration of 0-9 age group. Thus, the Stable Population Analysis and Census Survival Rate method which are well-suited for this purpose have been used here to obtain the vital rates for 1951-61 period.

For the 1961-74 period, we have used three additional methods which can be used in a situation free from the kind of bias noticed in the 1961 Census. The new methods are Rele, Reverse Survival Ratio and the Differencing method. Nevertheless, the main emphasis would be on the two methods that have been considered safe for 1961 data. Only some additional support would be sought from the rest three methods after a careful evaluation of their results.

Stable Population Analysis

Coale & Demeny have suggested this method for estimating the vital rates when the data pertaining to age distribution are defective and incomplete [20]. For its application, the concerned population requires to fulfil the condition of stability in terms of fertility, mortality and migration. In Bangladesh, fertility can be assumed almost constant over the last several decades but due to improved medical and public health facilities mortality has experienced some decline. Moreover, the Bangladesh population is not strictly close against migration. In order to avoid the impact of migration on the stability condition, the total population of 1961 and 1974 censuses as well as their age returns have been adjusted for the net migrants and for other missing population (cyclone deaths and war deaths) that took place during the intercensal periods. Thus the adjusted Bangladesh population can be regarded as quasi-stable in which case the Stable Population Analysis can be applied reasonably well.

A stable population corresponding to a given population can be identified by comparing the population characteristics r (the intercensal growth rate of the natural population) and the cumulative proportion c(x) of the population upto a certain age x. While a series of estimates can be obtained by comparing r and each successive value of c(x), it is suggested in the methodology that it is preferable to accept the value that corresponds to c(35) in case of female age-distribution [20]. We have accepted this suggestion, but only after carrying out the necessary adjustment for mortality decline assuming the year 1921 as the starting point of mortality change in Bangladesh.[3] Vital rates estimated by this method are given in Tables II and III. Details of the computation are given in the Appendix.

Census Survival Rate Method

This method too has been suggested by Coale and Demeny [20]. In essence, this method consists of projecting population at age x and above in the first census to the ages x+10 and above in the next census through the appropriate survival ratios, if the censuses are 10 years apart. Since no such survival ratios of our own experience are available, model life table survival ratios under different mortality levels have been used in the analysis. The appropriate mortality levels which produced the projected population equal to the enumerated population have been then obtained by interpolation, if necessary. From a series of mortality levels generated

[3]Analysis of the intercensal growth rates in Bangladesh since 1901 shows an increasing trend in the rates since 1921 with the exception of the 1941-51 decade The mortality condition of this period was seriously disturbed by the Great Bengal Famine of 1943 and by the partition of the Indian sub-continent in 1947. In view of this exogenous nature of disruption in this period, we have chosen 1921 as the starting point for mortality decline in this analysis.

INTERCENSAL GROWTH RATES OF POPULATION IN BANGLADESH

Period	Exponential G.R. (migration adjusted)*
1901-11	0.82
1911-21	0.61
1921-31	0.83
1931-41	1.31
1941-51	0.61
1951-61	2.56
1961-74	2.89

* Intercensal net migration figures upto 1951 has been taken from Khan [15], and the resources for the periods 1951-61 and 1961-74 have already been explained in the text.

by the process, the median value of the first nine values has been considered best approximation to the mortality level for the given population. Female death rate is computed first from the age-specific death rates corresponding to the chosen mortality level and the average age distribution of the given population. From this rate we then obtain fémale birth rate and the birth rate for the total population. Vital rates computed in accordance with this method are given in Tables II and III.

Rele Method

Rele [12] has developed a method of estimating birth rates for developing countries where the basic data relating to population are inadequate. This methodology has the advantage of wider applicability under changed circumstances. The strict assumptions of constant fertility and mortality in stable population analysis are absent in this methodology and it is capable of reading the changes in fertility over time. This method requires the census age-return and makes use of the Child Women Ratios(CWR). Also required in this methodology is a rough idea of the expectation of life at birth (e_o^o) during the last intercensal period to the nearest multiple of ten. Since e_o^o value of Bangladesh is estimated to be around 45 during 1961-74 [5 ; 13], the estimates of the birth rate are computed for this period by taking average of the estimates obtained for e_o^o of 40 and 50. Usually, the estimates obtained by this methodology refer to the period of five or ten years before the census depending on whether the child-women ratios use the children aged (0-4) or (5-9) in the numerator. The former child women ratio is likely to produce an underestimate and the latter an overestimate to the extent that the census involves under/over enumeration of young children. An estimate for the decade is then obtained by averaging the two estimates. The result is shown in Table III.

Differencing Method

A simple reasoning works behind this method. The approximate number of deaths during the intercensal period in the age group 5 years and above is taken to be equivalent to the difference between the total population of the first census and the total population aged 10 years and above in the second census, provided the two censuses are ten years apart. In order to obtain total number of deaths, this difference is then raised by a ratio of total deaths to deaths occurring to the population of age 5 and above. In this paper, the raising factor has been computed from three sources : (i) distribution of deaths in stable age-distribution corresponding

to r=.0288 and mortality level 11[8], (ii) Population Growth Estimation Experiment (PGE) project of Pakistan [9]; from this sources two separate ratios for 1964 and 1965 have been utilised, (iii) third is the outcome of CRL Demographic Surveillance System—Matlab [18]. Death rate for female population has been computed first and then we obtained the female birth rate and the birth rate for the total population (Table III).

Reverse Survival Ratio Method

The basic requirement of this method is the knowledge of mortality level prevailing in the country. The actual level of mortality in Bangladesh and its rate of change over time are not, however, known. Nevertheless, depending upon the experiences of BFS and BRSFM [5; 13] mortality level in terms of e_o^o value has been assumed at 45 for 1961-74 period. The decline in the mortality rate or the rate of gain of e_o^o value over the past periods has been assumed to be 0.5 year per year upto 1971 [21] after which it has been assumed to have remained constant. The method involves estimation of the size of the birth cohort on the basis of population enumerated in the age group (0-4) and (5-9) in the census; and the respective total population is then obtained by interpolation. In the present analysis, however, instead of reverse surviving only the first two age groups, we have reversed the entire populations of 1974 census to the previous periods. The respective denominators of the birth rates are then interpolated from this backward-projected population. The birth rate for the decade is then obtained from the mean of the birth rates computed for the two quinquennia of 1964-74 period.

IV. DISCUSSION AND CONCLUSION

There is nothing that can replace accurately collected registration data from which birth and death rates can be computed by a simple operation. In the absence of these, various methods are utilized which can at best help in coming close to the actual levels of these rates. Ideally, with accurate data and with the assumption of stable population fully satisfied, the estimates of various methods would tend to converge. But this can hardly happen in reality. Nevertheless, it is hoped that the estimates obtained from the use of various methods will serve as indicators of the actual levels of birth and death rates during the periods. It is in this light that the evaluation of the results is attempted.

Estimated vital rates for the period 1951-61, as displayed in Table II, show that the Census Survival Rate method produces a higher estimate than the Stable Population Analysis. This is so, because although the Census Survival Rate method has the advantage of utilizing a large proportion of the population (i.e., total population of age 10 and above), it is affected by the overenumeration of 0-9 age group. If there were no misreporting of ages in 1961, a section of the population who have been erroneously included in 0-9 age group, would be recorded in the ages 10 and above making an upward shift to the estimated mortality levels. Under such higher mortality level, the estimates of the vital rates for Bangladesh would have been lower than the estimates actually obtained. On the other hand, since the Stable Population Analysis considers the cumulative proportion of population upto age 35, it has not been disturbed by the overenumeration of 0-9 or the underenumeration of 10-19 age group. Moreover, even if there did occur some misreporting to the cumulative population upto age 35, it would have a very trivial effect on the cumulative proportion ; and it is this proportion rather than the absolute figure that is in concern in this method. The method of Stable Population Analysis thus seems to be particularly suited to our specific context. On the basis of this Analysis and also supported by the Census Survival Rate method, it appears that the birth rate in Bangladesh during 1951-61 was in the vicinity of 49 per thousand population. The death rate would then be around 23.

All the five alternative methods outlined earlier have been applied to obtain the vital rates for 1961-74 (or 1964-74) period. Table III presents all these estimates. A look at this table shows that the Rele method with 5-9 age group has failed to produce an estimate for 1964-74 period. It failed because it produced a value of GRR, an intermediate product in the process of estimation, which fell outside the range of the given value of GRR in the methodology. The Reverse Survival Ratio method using the age groups 0-4 and 5-9 separately has yielded two widely varying estimates for the two quinquennia. Such a large difference (about 15.5 points) between the estimates of the two quinquennia of a single decade casts doubt on the reliability of the estimates given the demographic conditions of the country. The Differencing method that indirectly utilizes the 0-9 age group has placed the birth rate at around 57 and this is the highest estimate of all. Having accepted the birth rate for 1951-61 to be 49, so high a figure for the 1961-74 period cannot by any means be deemed credible unless sufficient evidences of such sudden increase in fertility are available. It would thus appear judicious to avoid the estimates based upon the above three methods.

We shall, therefore, rely more on Stable Population Analysis and Survival Rate method. However, there is a problem in Stable Population Analysis relating to adjustment in vital rates for the mortality change during the last several decades. As mentioned before, mortality probably began to decline in Bangladesh since 1921, and the time elapsed between 1921 and mid-period of 1961-74 is more than 45 years. But adjustment factors are available only for a period ranging upto 40 years since the beginning of decline in mortality. We were, therefore, constrained to adjust the vita rates with the factors corresponding to the time period 40. We do not however, feel that this approximation will be terribly bad because adjustment factors for large t values, specially in the case of continuous decline of mortality for a sufficiently long period, do not differ significantly.

The Census Survival Rate method has produced a slightly higher estimate for 1961-74 period than the Stable Population Analysis. Despite this, the estimates obtained by the two methods are fairly consistent. Following these methods, the birth rate in Bangladesh during 1961-74 was around 47 per thousand population and its associated death rate around 18.

These estimates indicate that both fertility and mortality are declining in the country. Yet, in the presence of so many natural disasters such as war, famine and cyclone, which the country has been experiencing since mid 60's, it is somewhat difficult to make any conclusive statement regarding any trend in these rates. For example, the death rate during 1970 rose upto 25 and in 1971 upto 40. Both fertility and mortality since 1974 famine have shown severe fluctuations in a rural area of Bangladesh [2]. However, to identify the impact of such events on fertility and mortality in the long run we can probably depend on the country's experience in the past. During the 1941-51 decade when the country was seriously disturbed by the Great Bengal Famine of 1943 and by the partition of the Indian sub-continent in 1947, a similar dislocation in the vital rates occurred. But since those events were incidental in nature the situation returned back to normal soon after the temporary effect of the phenomenon was over. Similarly, if we consider the recent environmental anomalies as something accidental in nature with only temporary effects, then the observed trend in the vital rates can be accepted as valid and the decline in the rates can be interpreted as demographic transition taking place in the country. The decline in death rate can perhaps, be claimed to be an undisputed fact, and can be explained by the various medical and public health measures taken in the past. On the other hand, there is no direct evidence of decline in fertility, but there is

some indirect evidence in so far as compared to the past, age, sex, and marital status composition in the recent periods has been more favourable to lower fertility, as can be seen for the following statistics :

	1961	1974
Percentages of women in the reproductive ages 15-44 to all women	40.35	38.05
Sex ratios (females per 100 males) in the reproductive age 15-44	96.38	95.29
Percentage of currently married women in the reproductive ages 14-55	0.89	0.87
Percentage of currently married women in the reproductive ages 15-44 to total population	0.17	0.16
Percentage of females in the reproductive ages 15-44 to total population	19.4	18.3

TABLE I

PERCENTAGE AGE SEX DISTRIBUTION OF 1951, 1961 AND 1974 CENSUS POPULATION

Age Group	1974		1961		1951	
	Male	Female	Male	Female	Male	Female
0-4	16.23	17.61	17.38	19.13	13.87	15.37
5-9	17.80	18.95	18.48	19.03	14.49	15.32
10-14	13.45	12.19	9.91	8.32	13.47	11.70
15-19	8.51	8.03	7.30	8.10	9.40	10.58
20-24	6.52	7.25	6.92	8.12	7.81	8.82
25-29	6.35	7.30	7.60	8.16	7.74	8.35
30-34	5.49	5.89	6.42	6.31	6.86	6.76
35-39	5.49	5.17	5.91	5.12	6.04	5.50
40-44	4.70	4.40	4.75	4.54	5.22	4.74
45-49	3.72	3.19	3.86	3.27	4.27	4.28
50-54	3.46	3.21	3.59	3.27	3.86	3.49
55-59	2.09	1.67	2.32	1.77	2.31	1.97
60+	6.18	5.13	5.55	4.86	4.66	4.17
	100.00	100.00	100.00	100.00	100.00	100.00

TABLE II

ESTIMATES OF BIRTH AND DEATH RATES IN BANGLADESH, 1951-61 FOR TOTAL POPULATION

(rates are in per 1000 population)

Method/Period	Total Population	
	Birth Rate	Death Rate
1. Stable Population Analysis		
(i) t = 35	49.53	23.91
2. Census Survival Rate Method	52.60	26.98

TABLE III

ESTIMATES OF BIRTH AND DEATH RATES IN BANGLADESH, 1961-74 FOR TOTAL POPULATION

(rates are in per 1000 population)

Method/Period	Total Population	
	Birth Rate	Death Rate
1. Stable Population		
(b) t = 40	47.4	18.5
2. Census Survival Ratio Method	48.1	19.2
3. Rele's Method, $e_0^o = 45$		
(a) for 1969-74	45.3	16.4
(b) for 1964-69	*	*
4. Reverse Survival Ratio Method		
(a) for 1969-74	44.9	16.0
(b) for 1964-69	60.4	31.5
(c) for 1964-74	52.6	23.7
5. Differencing Method		
i) Raising Factor from Stable Population	56.9	28.0
ii) Raising Factor from PGE Survey (from 1964 data)	56.2	27.3
iii) From PGE 1965 Data	57.7	28.8
iv) CRL-1974	58.8	29.9

*Estimate of vital rates were not possible because of high GRR value.

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Appendix

1. Stable Population Analysis

TABLE I

BIRTH RATE ESTIMATED BY STABLE POPULATION ANALYSIS 1951-61
(r = .0251, t = 35)

Age	Population upto age x	Estimated Birth Rate	Adjustment Factor for t = 35, k = .91	Adjusted Birth Rate
5	.1913	55.73	.965	53.78
10	.3816	78.76	.974	76.52
15	.4647	55.40	.9964	55.20
20	.5457	47.21	1.020	48.15
25	.6269	45.08	1.043	47.02
30	.7085	46.76	1.063	49.71
35	.7716	46.76	1 085	30 73

$$K = \frac{\cdot 0251 - .0071}{1921 - 1956} X\ 17.3 = .0091$$

Birth rate for female population = 46.76
Birth rate for total population = 45.65
With adjustment for declining mortality :
Birth rate for female population = 50.73
Birth rate for total population = 49.53.

TABLE II

BIRTH RATE ESTIMATED BY STABLE POPULATION ANALYSIS, 1961-74
(r=· 0288, t=40)

Age	Population upto Age x	Estimated Birth Rate	Adjustment Factors for t=40, K=.96	Adjusted Birth Rate
5	.1761	43.9	.9587	42.1
10	.3656	62.7	.9693	60 8
15	.4875	59.3	.9962	59.1
20	.5678	45.1	1.0250	46.2
25	.6403	45.6	1.0490	47.8
30	.7133	44.9	1.0701	48.0
35	.7723	44.0	1.0883	47.9
40	.8240	44.0	1.0940	48.1

$$K = \frac{\cdot 288 - \cdot 0071}{40} x\ 17.8 = \cdot 0096.$$

Birth rate for female population = 44.0
Birth rate for total population = 43.5
Birth rate with adjustment for declining mortality :
Female population = 47.9
Total population = 47.3.

Census Survival Rate Method, 1951-61

TABLE III

THE MIGRATION ADJUSTED FEMALE POPULATION OF BANGLADESH, 1961 AT AGE X AND OVER. PROJECTED POPULATION OF 1961 UNDER DIFFERENT MORTALITY LEVEL (WEST MODEL LIFE TABLE) AND THEIR MORTALITY LEVELS

Age	Migration Adjusted Female Population of Age x and Above-1961	Level-1	Level-3	Level-5	Level-7	Level-9	M. Levels	Around Mortality Levels
10	15,903,479	15,319,654	16,011,370	16,590,589	17,088,096	17,522,622	2.7	2.7
15	13,765,119	13,055,251	13,350,411	14,061,340	14,460,523	14,810,369	3.7	3.7
20	11,682,492	10,379,003	10,359,330	11,267,148	11,620,384	11,930,900	7.4	5.8
25	9,594,500	8,372,262	6,798,802	9,160,959	9,475,352	9,751,939	7.3	6.4
30	7,496,335	6,619,961	6,988,556	7,302,285	7,575,017	7,815,230	6.4	6.8*
35	5,874,201	5,201,258	5,515,572	5,783,832	6,017,440	6,223.463	5.8	6.9
40	4,557,339	3,892,079	4,150,126	4,371,134	4,564,170	4,734,629	6.9	7.4
45	3,388,343	2,857,299	3,066,984	3,247,330	3,405,378	3,543,172	6.8	7.8
50	2,546,717	2,030,454	2,199,286	2,346,247	2,475,040	2,589.209	8.2	8.2
55	1,705,941	1,341,513	1,474,729	1,590,469	1,692,811	1,783,753		
60	1,249,508	905,334	1,010,958	1,103,306	1,185,357	1,258,400		

*Median level mortality.

Census Survival Ratio Method, 1964-74

TABLE IV

FEMALE POPULATION ADJUSTED FOR MIGRATION AND EXTRA DEATH AT AGE X AND ABOVE-1974 PROJECTED 1974 POPULATION UNDER DIFFERENT MORTALITY LEVELS (WEST MODEL LIFE TABLE) **AND THEIR MORTALITY LEVELS**

Age	Adjusted Female Population at Age x & Above-1974	Level-5	Level-7	Level-9	Level-11
10	23,049,312	22,524,268	23,209,160	23,806,855	24,346,995
15	18,620,448	18,343,721	18,866,104	19,324,650	19,744,432
20	15,701,664	13,626,238	14,071,039	14,462,348	14,822,650
25	13,066,944	11,297,887	11,699,748	12,053,549	12,380,999
30	10,414.272	9,365,555	9,724,104	10,040,089	10,334,341
35	8,273,760	7,524,161	7,835,264	8,109,788	8,367 494
40	6,395,136	5,706,088	5,964,975	6,193,731	6,399,222
45	4,796,352	4,306,929	4,522,255	4,712,832	4,884,349
50	3,637,920	3,161,725	3,339,870	3,497,879	3,640,462
55	2,471,040	2,185,168	2,329,136	2,457,153	2,573,133
60	1,862,784	1,518,998	1,635,220	1,738,740	1,832,914

(*Contd.*)

Age	Level-13	Level-15	Level-17	Level-19	Exact Level	First Nine Values of Mortality Levels in Order
10	24,806,228	25,187,169	25,615,716	25,974,571	6.36	6.06
15	20,097,018	20,373,852	20,715,558	21,002,300	6,06	6.53
20	15,122,481	15,349,145	15,647,923	15,896,391	17 43	9.97
25	12,651,599	12,851,620	13,125,306	13,351,786	16.57	10,27
30	10,575,260	10,749,338	10,997,081	11,200,695	11.66	10.96*
35	8,575,928	8,721,582	8,940,900	9,119,082	10.27	10,96
40	6,583.375	6,697,656	6,886,032	7,036,065	10.96	11,66
45	5,038,396	5,126,776	5,289,588	5,416,243	9.97	16.57
50	3,768,790	3,835,364	3,976,930	4,083,317	10.96	17.43
55	2,677,819	2,724,671	2.846,882	2,934,282	9.23	9.23
60	1,918,161	1,949,107	2,055,501	2.127,261	11.70	11.70

*Median mortality level.

Note

Price Elasticities of Demand for Bangladesh's Jute

by

VINOD THOMAS*

Bangladesh is the largest exporter of jute in the world, selling about 75% of all internationally traded raw jute and about 40% of jute goods. Bangladesh is also critically dependant on jute for its foreign exchange. Raw jute and jute goods together earn 70-80% of the nation's export earnings.

The extent to which Bangladesh can independently influence its export earnings by varying the export price of jute depends on the price elasticities of demand faced by the country for its raw jute and jute goods. While knowledge of the above elasticities is important, no estimates are currently available. Some measures exist, however, for the world price elasticity of demand for jute goods. This note first uses a well-known demand relationship to derive estimates of elasticity for Bangladesh's jute goods from that for the world. The same method could be used to measure the demand elasticity for the exports of products from other developing countries for which typically only the world demand elasticity is available.

This note then uses a well-known relationship from the theory of derived demand to calculate the world price elasticity demand for raw jute from that for jute goods. Having thus estimated the world demand elasticity for raw jute, the elasticity facing Bangladesh for raw jute is then calculated, as done for the case of jute goods. These preliminary estimates presented in this note rely on assumed values of certain parameters. The assumptions made, however, are perhaps not unrealistic ; the results, therefore, may be considered to be more than illustrative.

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* The author is an Economist in the World Bank. The views expressed in this Note are those of the author and not necessarily of the World Bank. He would like to thank Neela Manage for valuable help in preparing this Note.

Jute Goods

If Bangladesh were the only exporter of jute goods, the price elasticity of demand facing Bangladesh would be the same as the world price elasticity of demand for jute goods. If, on the other hand, there are other competing suppliers of jute goods, the demand elasticity facing Bangladesh will depend on (i) the world demand elasticity, (ii) the price elasticity of supply of the rest of the world (ROW) for jute goods and (iii) the relative shares of Bangladesh (BD) and the rest of the world in exports of jute goods. It can be shown that in this case the following precise relationship would hold : [1]

BD's demand elasticity = (World demand elasticity—

(ROW's supply elasticity x ROW's shares)) ÷ BD's share ... (1)

Grilli and Morrison [1] have estimated the world demand elasticity for jute goods to be —2.67. For the purpose of illustration, two alternative values of —2 and —5 may also be assumed. These values represent highly elastic demand curves and they reflect the large degree of substitution that exists in consumption between jute goods and synthetics. Equation (1) implies that the elasticity of demand facing Bangladesh will be more than the above values for the world depending on how large are the supply elasticity and the share of exports of the rest of the world for jute goods. The share of the rest of the world in jute goods exports is currently about 60%. The rest of the world's supply elasticity is perhaps no more than .5—two alternative values .1 and .5 may be assumed for illustration.

Using the above values of the parameters, equation (1) may be estimated. Table I sets out the results. For the case of a world demand elasticity of —2.67 (Grilli and Morrison [1]), the demand elasticity facing Bangladesh is about —7. In general, the Bangladesh elasticity is more than 2—1/2 times larger than that of the world. The results do not appear to be very sensitive to changes in the value assumed of the jute goods supply elasticity of the rest of the world.

Raw Jute

The demand for raw jute (RJ) with respect to price is derived from that for jute goods (JG). The theory of derived demand provides a precise expression that would relate the world demand for raw jute to the world demand for jute goods [2], According to this expression, the raw jute

[1]The derivation of this formula is given in various books. See, for example, Linder [3].

demand elasticity depends on (i) jute goods elasticity, (ii) elasticity of substitution between raw jute and other inputs (OI) in jute manufacturing, (iii) price elasticity of supply of inputs other than raw jute, and (iv) the relative shares of raw jute and the other inputs respectively in jute manufacturing. This expression can be simplified by applying a fairly realistic assumption that raw jute and the other inputs are used in fixed proportion in jute manufacturing, i.e., the elasticity of substitution is zero. In that case the following equation would hold :

RJ demand elasticity = (JG demand elasticity × RJ share × OI supply elasticity) ÷ [OI supply elasticity— (JG demand elasticity × OI share)] ... (2)

To estimate equation (2), one may again use values —2. —2.67 and —5 for the Jute Goods (JG) demand elasticity. It may be realistically assumed that the shares of raw jute (RJ) and the other inputs (OI) in jute manufacturing are 50% each. Then the raw jute demand elasticity according to equation (2) would depend on supply elasticity of the other inputs. For a preliminary calculation, two values of the supply elasticity of other inputs may be tried—1 and 2. The larger this supply elasticity, the larger is the raw jute demand elasticity, but as it turns out the results are not quantitatively very sensitive to the values used.

Table II represents the estimates of the world demand elasticity for raw jute. For the case of a jute goods demand elasticity of —2.67, the raw jute elasticity is —.6 — —.8. The larger the jute goods demand elasticity, the larger is the raw jute demand elasticity. For all cases considered, the raw jute elasticity is considerably less than that of jute goods—it appears that this would be so for any reasonable value of the supply elasticity of other inputs.

From the estimates made above of the raw jute demand elasticity for the world, one can calculate the raw jute demand elasticity facing Bangladesh using the same method embodied in equation (1). To recapitulate, the Bangladesh elasticity would exceed that of the world depending on how large are the supply elasticity and the export share of raw jute of the rest of the world. The present share of the rest of the world in exports of raw jute is about 25%. The supply elasticity of the rest of the world is perhaps no more than .5 and is more likely to be much lower. Two alternative values of the supply elasticity—.1 and .5 are used and as in the earlier case, the results are not very sensitive to changes in its value.

Table III gives the estimates of the price elasticity of demand for raw jute facing Bangladesh. To simplify the exposition only three values of

the world demand raw jute elasticity are considered—each corresponding to the cases where world jute goods elasticity is respectively —2, —2.67 and —5.0 and the supply elasticity of the other inputs is 1. In all these cases, Bangladesh's price elasticity of raw jute demand is less than, but close to, one.

Bangladesh's raw jute elasticity was derived in turn from (a) the world raw jute elasticity and (b) world jute goods elasticity. Bangladesh's raw jute elasticity increases as (a) and (b) increase—but less than proportionately because of the interaction of the other parameters.

According to Table III, the raw jute demand facing Bangladesh is generally inelastic. However, for larger values of world demand elasticities and/or large values of raw jute supply elasticities of the rest of the world, the raw jute elasticity facing Bangladesh rises above one.

Conclusion

Comparing Tables I and III, we find that Bangladesh faces a far more elastic demand schedule for jute goods than for raw jute. The jute goods demand elasticity facing Bangladesh is large and is implicitly determined by world demand elasticity as dictated by the price of jute's competitor, synthetics. As the rest of the world's ability to supply jute diminishes (i.e., lower supply elasticity of ROW), Bangladesh's demand elasticity diminishes—but not markedly (Table I). The raw jute demand elasticity for the world would be lower depending on how difficult it is to obtain or release the other factors in jute manufacturing (Table II). Further, the raw jute demand from Bangladesh will be even less elastic, as the rest of the world finds it more difficult to supply raw jute (Table III).

TABLE I

PRICE ELASTICITY OF DEMAND FOR JUTE GOODS FACING BANGLADESH

World Demand Elasticity for JG / ROW's Supply Elasticity for JG	—2.0	—2.67	—5.0
.1	–5.1	—6.8	—12.6
.5	—5.7	—7.4	—13.3

Notes: JG→Jute Goods.
ROW→Rest of the World.

TABLE II

PRICE ELASTICITY OF DEMAND FOR RAW JUTE FOR THE WORLD

World Demand Elasticity for JG / Supply Elasticity for OI	—2.00	—2.67	—5.00
1	— .50	— .57	— .71
2	— .67	— .80	—1.10

Notes : JG→Jute goods.
OI→Other inputs.

TABLE III

PRICE ELASTICITY OF DEMAND FOR RAW JUTE FACING BANGLADESH

World Demand Elasticity for RJ / ROW's Supply Elasticity for RJ	— .5	— .57	— .71
.1	— .71	— .80	— .99
.5	— .85	— .95	—1.10

Notes : RJ→Raw Jute
Row→Rest of the World.

The numerical examples suggest that Bangladesh has a far greater ability to independently vary its raw jute price compared to its jute goods price. For any reasonable case, Bangladesh has little flexibility with regard to augmenting export earnings by trying to independently vary the price of jute goods. It appears that Bangladesh is relatively more of a price setter in the case of raw jute goods compared to that of jute goods. Even for raw jute, however, in many cases the demand elasticity, according to the present estimates, is close to one. In that case, it implies that even

raw jute export earnings are not easily influenced through an independent manipulation of the raw jute price by Bangladesh. Further, the elasticity estimates presented thus far were built up from short-run estimates of the world demand elasticities made by Grilli and Morrison. Their regression equation allows no time lags and relies on quarterly data for the 1969-72 period. Consequently, the price elasticity may be interpreted to be a short-term one, with the corresponding long-term one being likely to be higher.[2] This qualification for the long run would make the demand estimates more elastic than those calculated in this note.

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[2] More precisely, the long-term elasticity (LRE) is related to the short-term elasticity (SRE) as follows :

$$\text{LRE} = \frac{\text{SRE}}{(1 - \text{Coefficient } P_{t-1})}$$

Where P_{t-1} is the price in the previous time period. Thus, the larger the response in demand in this time period to the price in the previous time period, the more the LRE will exceed the SRE.

Note

Alternate Strategies for Beginning Contraceptive Use : The Case of Bangladesh*

by

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AND
W.H. MOSLEY[3]

I. INTRODUCTION

The question of when in the postpartum period to begin use of contraception has concerned workers in family planning for a number of years. The International Postpartum Programme began in 1966, working on the premise that women who had recently given birth were unusally motivated to accept and use contraception [6, p. xi]. While this may well be true, there are also disadvantages to acceptance shortly after birth. The principal disadvantage among these is the overlap of contraceptive use with the natural protection of postpartum amenorrhea. More recently, with a growing emphasis on the use of oral contraceptive pills, two new, closely related, concerns about postpartum acceptance have arisen. They are : 1) the possibility of reducing milk flow in breastfeeding mothers ; 2) possible truncation of postpartum amenorrhea. These effects have not been included in the present analysis. However, because of their special importance in Bangladesh where breastfeeding is virtually universal and postpartum amenorrhea prolonged, they will be discussed briefly later. This paper uses a modeling procedure to evaluate strategies of acceptance in the Bangladesh context. The model was developed by Potter. It is described briefly in an Appendix to this paper and in greater detail in [5].

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II. STRATEGIES AND FACTORS INFLUENCING THE CHOICE OF BEST STRATEGY

There are a number of different recommendations that can be made as to when couples ought to begin use of contraception. These fall into three broad groups : 1) Fixed date strategies suggest that women begin use exactly a certain number of months (designated T) after birth, 2) The postamenorrheic strategy requires women to begin use after their first menstrual cycle, 3) A mixed strategy recommends beginning use either after first menstruation or after T months postpartum, whichever comes first.

Note that the mixed strategy approaches either the fixed date or the postamenorrheic strategy depending upon the average length of postpartum amenorrhea and the value of T chosen. If the value of T is low, the mixed strategy is very similar to the fixed date strategy. This is especially true as the average length of postpartum amenorrhea increases. On the other hand, if the value of T is high, then the mixed strategy becomes more like the postamenorrheic alternative.

The strategy chosen should minimize overlap and any adverse effects of contraceptive use on lactation and the duration of amenorrhea, while at the same time taking advantage of the disposition to use contraception women may have immediately following birth and preventing pregnancies before the acceptance date. The ability to fulfil these conflicting goals will be affected by continuation rates, the length of postpartum amenorrhea, natural fecundability, the extent of anovulation in the first few menstrual cycles following birth and the degree of compliance with the recommended starting time. Therefore, the appropriate strategy for a country or area will depend in large part upon the values these factors have in the particular area involved.

In general, in societies with high natural fecundability, short periods of postpartum amenorrhea and high rates of continuation—for example, most industrial nations—a strategy with a low T value, whether fixed date or mixed, is likely to be the most advantageous. In areas with low natural fecundability, prolonged amenorrhea and poor continuation a postamenorrheic or mixed strategy with a relatively high value of T will probably be preferred.

III. THE SITUATION IN BANGLADESH

Bangladesh combines all of the traits that make a postpartum or short T strategy particularly inappropriate. Currently, however, the Bangladesh government recommends a mixed strategy for oral pill acceptors, with use

beginning either after first menstruation or 5 months postpartum, whichever comes first. Use of condoms, foam or IUD's may begin at any time after birth. This is an implied postpartum strategy without any explicit instructions or vehicle for reaching women shortly after birth.

An experimental programme that relies heavily on oral pills is evaluating two different mixed strategies. One is a short T strategy recommending that use begin either after first menstruation or 6 months postpartum. The other suggests a T value of 18 months [4]. The results presented below will compare the postpartum approach, 6 and 18 month fixed and mixed strategies, and the postamenorrheic alternative.

The model requires estimates of five parameters : natural fecundability (f) ; effectiveness of the contraceptive (e) ; the mean length of postpartum amenorrhea for specification of the probability distribution of anovulation (h) ; an estimate of the proportion of first menstrual cycles that are ovulatory (λ); and the monthly risk of discontinuing contraception during an anovulatory month (d).

A number of assumptions have been made to simplify the algebra of the model. First, women begin contraceptive use near the start of a month, they conceive about the middle of the month, they discontinue use near the end of the month, and they do not begin use during a recognizable pregnancy. Second, after discontinuing use women do not reaccept contraception before their next conception. Third, all women follow the acceptance rule scrupulously. That is, they begin use exactly at the time prescribed, be that in month T or after first menstruation, without any anticipation or procrastination. (For a more detailed discussion of the simplifying assumptions see [5]).

Finally, the models consider only the subset of the female population that wants to accept contraception and assumes that the fecundability and length of amenorrhea of these women are the same as in the female population as a whole. This point is important not because it differentiates women by motivation to use contraception, but because it seeks to emphasize that some women who want to accept contraceptives are prevented from doing so by pregnancy. This is critical because it means that the results of the modeling procedure cannot be compared directly with actual field test results. In the field situation it is virtually impossible to identify women who would have accepted had they not become pregnant prior to the recommended starting time. At the same time, analysis of the differentials in waiting time to next conception only for acceptors is biased since women who want to accept but are prevented from doing so because

they conceive prior to beginning use, tend to have relatively short postpartum amenorrhea. Thus, by considering acceptors only, an inefficient acceptance strategy might appear to be highly effective because it selects women with long amenorrhea and therefore with long birth intervals. (For an example and discussion of this bias see [5, p. 30]).

The values assigned the five parameters used in this analysis are :[1]

$$f = 0.1, 0.15$$
$$e = .95$$
$$h = 18.9$$
$$\lambda = 0.7$$
$$d = .0838, .0561, .0289, .0119$$

The first value for each parameter is believed to best reflect the situation of Bangladesh. That is, natural fecundability is low, amenorrhea is prolonged and the rate of discontinuation of use is high. The other values are used to show how shifts in the respective parameter affect the relative efficiency of alternate strategies.

IV. RESULTS

The results of the analysis using the values believed to be most characteristic of Bangladesh are shown in Table I. The expected wait to next conception in the absence of all contraception would be 28.9 months, assuming $h = 18.9$ and $f = 0.1$. The values presented in Table I are the mean number of months added to this expected wait of 28.9 months by using contraception under the various acceptance rules.

For example, the total expected wait to next conception under the postpartum rule would be 31.8 months, while under the postamenorrheic rule it would be 38.9 months. There is a clear trend in these data for

[1]The value of 0.1 for f has been obtained from unpublished data provided by Alauddin Chowdhury, based on a study of Natural Fertility in Matlab and 0.15 is the assumed maximum value for young women with husband present. Value of e is arbitrarily assigned. It is probably conservative in that it overestimates the true use effectiveness. Values of h and λ are based on [2] and unpublished data of Sandra Huffman.

The value .0838 of d is based on unpublished preliminary data from the Companiganj Health Project. This value implies that 35 per cent of acceptors are continuing at 1 year and 12 per cent at 2 years after acceptance. The remaining values are arbitrarily assigned and imply continuation at 2 years by 25, 50 and 75 per cent respectively.

long T strategies to delay next conception more effectively than short T strategies, and for mixed strategies to be more effective than fixed strategies for a given T value.

TABLE I

MEAN MONTHS ADDED TO THE INTERVAL TO NEXT CONCEPTION BY ACCEPTANCE STRATEGY

Acceptance Strategy	Mean Months Added
Postpartum	
(Fixed T=1)	2.9
Fixed T=6	4.2
Mixed T=6	4.3
Fixed T=18	6.0
Mixed T=18	7.9
Postamenorrheic	10.0

Assumptions : f=.1, e=.95, h=18.9, λ=.7, d=.0838.

TABLE II

MEASURES OF SHORT-RANGE AND LONG-RANGE EFFICIENCY BY ACCEPTANCE STRATEGY

Acceptance Strategy	Measures of Efficiency*		
	(1)	(2)	(3)
Postpartum			
(Fixed T=1)	27.0	0.0	8.7
Fixed T=6	38.9	1.4	7.1
Mixed T=6	39.8	0.4	7.1
Fixed T=18	55.8	20.8	2.8
Mixed T=18	73.4	3.1	2.8
Postamenorrheic	93.0	7.0	0.0

Assumptions : f=.1, e = .95, h=18.9, λ=.7, d=.0838.

*(1) $P_f + P_x$ — The per cent of women protected for at least one fecundable month.

*(2) P_c — The per cent of women who fail to begin use of contraception before next conception.

*(3) φ— The mean number of months of overlap of contraception and postpartum anovulation.

However, there are two important point to notice. First, none of the strategies has much impact on the expected wait to next conception. This issue will be dealt with below. Second, the mean months added measures only long-range effectiveness of the strategies. It is possible to evaluate specific aspects of their short and long-range relative efficiency using the measures presented in Table II.

The issue of short-range versus long-range efficiency is important since some strategies may effectively control fertility over the long-run, but allow a large number of women to become pregnant before acceptance. The fixed, T = 18 approach is an example of a strategy that has a good long-run impact as indicated by its prolongation of the expected wait to next conception by 6.0 months. However, it is a very bad strategy from the point of view of the number of potential users conceiving before acceptance (20.8 per cent). This strategy achieves a reasonable expected wait to next conception because it has a relatively low mean overlap of contraceptive use with .postpartum amenorrhea.

The postpartum strategy, on the other hand, eliminates all conceptions prior to acceptance. However, it makes only a small contribution to prolonging waiting time to conception because it has a very high mean number of months of overlap between use and amenorrhea.

The mixed, T = 18 is a very effective strategy under the given assumptions, because it retains the low mean number of months of ovelap of the fixed, T = 18 approach, but also has a relatively low rate of conception before beginning use. The postamenorrheic strategy, the other highly effective approach, allows a slightly greater proportion of conception before use, but is more effective in the long-run because it eliminates overlap entirely.

While the tradeoffs of the various strategies need to be considered carefully , on balance, it appears from these data and under the assumptions of this model, that the mixed T = 18 or the postamenorrheic model is most likely to give results that are satisfactory for all concerned.

V. A CAVEAT

It must be remembered that the model assumes all women accept (or become pregnant) precisely in accordance with the acceptance rule. They are assumed neither to procrastinate beyond nor to accept before the specified time for beginning use.

In reality many women no doubt would not accept at the specified time. For example, a fixed, T=18 rule would probably be impossible to enforce because women who were eager to prevent another pregnancy would insist upon beginning use earlier, particularly if they began to menstruate before 18 months. Under the mixed, T=18 and the postamenorrheic rules procrastination would probably be a greater problem than anticipation. The penalties for such procrastination could be great, because most or all women have begun to menstruate before they are to accept.

In an experimental programme in the Matlabarea of the Cholera Research Laboratory, Dacca, preliminary results from the first 12 months of field experience indicate that the areas where the mixed, T=6, rule has been used, may have experienced a greater decline in fertility than the areas following the mixed, T=18, approach. Over the short-run this is to be expected since, in our model, during the first 13 months the cumulative fertility of the mixed, T=6 rule is lower than the fertility for the mixed, T=18 rule. From the 14th month onward, acceptors under the mixed, T=18 rule have lower cumulative fertility. However, there is speculation that procrastination may also be influencing the experimental results. Some investigators believe that there is a tendency for groups of women to accept at the same time. By waiting until all the members of the group are eligible, some must procrastinate and run the risk of pregnancy. Unfortunately, the data necessary to evaluate the existence and impact of procrastination (or anticipation) are not available to the present investigators. Hopefully, further results from this experimental situation will help to clarify this issue.

VI. OTHER FACTORS

Continuation Rates

As noted above, none of the acceptance strategies greatly prolongs the mean waiting time to next conception. This is in large part due to the high discontinuation rates believed to characterize most contraceptive distribution programmes in Bangladesh. The importance of continuation rates in determining contraceptive impact can be seen in Table III.

Notice, for example, that given the poor continuation rates of Bangladesh, even the most favourable strategy increases the expected interval to next conception by only about 10 months. If, however, discontinuation rates could be cut so that 75 per cent of the acceptors continue use for 2 years, even the least favourable strategy adds 42 months to the birth interval, thus more than doubling the waiting time to next conception.

TABLE III

MEAN MONTHS ADDED TO THE INTERVAL TO NEXT CONCEPTION BY ACCEPTANCE STRATEGY AND MONTHLY DISCONTINUATION RATE, d

Acceptance Strategy	Monthly Discontinuation Rate, d*			
	.0838	.0561	.0289	.0119
Postpartum				
(Fixed T=1)	2.9	6.2	17.2	45.8
Fixed T=6	4.2	7.9	19.3	47.7
Mixed T=6	4.3	8.1	19.6	48.2
Fixed T=18	6.0	9.6	19.5	42.2
Mixed T=18	7.9	12.4	24.5	52.2
Postamenorrheic	10.0	14.5	26.2	52.5

Other Assumptions: e=.95, f=.1, h=18.9, λ=.7.

*A discontinuation rate of .0838 implies that 35 per cent of acceptors are continuing use at 1 year, 12 per cent at 2 years after acceptance. Discontinuation rates of .0561, 0289 and .0119 imply continuation at 2 years of 25, 50 and 75 per cent respectively.

Some other points may be noted from Table III. Most importantly, the relative efficiency of the short T strategies increases rapidly as continuation rates are improved. This is because short T strategies minimize the percentage of women becoming pregnant before acceptance, irrespective of continuation rates. With improved continuation, the proportion deriving at least some protection during fecundable months, is increased greatly, even though the mean number of months of overlap of use with amenorrhea may also increase somewhat.

Next, for all levels of continuation the short T strategies give very similar results irrespective of whether a fixed or mixed model is used. This is because very few women begin menstruation before 6 months postpartum. Thus conception before acceptance is not a problem with short T strategies, given the long amenorrhea and low fecundability in Bangladesh. For long T models, on the other hand, the relative efficiency of the fixed approach falls very rapidly, not only with respect to the long T, mixed model, but with respect to all other strategies. This decline in the efficiency of the long T (fixed strategies) is another indication of the increasing importance of conception before acceptance in determining the mean months of protection when continuation rates are high.

Finally, while the lowest discontinuation rate may be unobtainable, these data indicate there are considerable payoffs even for more modest,

and more attainable declines in the discontinuation rate. While it is admittedly difficult to improve continuation, at least one programme in Bangladesh has reported achieving 70-75 per cent of acceptors continuing at one year [3]. This programme includes some special inputs, particularly with respect to the high educational attainment of its field staff and unusually good access to clinical and backup service. Nevertheless, its basic approach does not differ significantly from the approach of other contraceptive distribution programmes, including that of the government. This programme should therefore, offer encouragement that improvement in continuation is possible without radical programme changes.

Age, Natural Fecundability and Length of Amenorrhea

The question of age-specific data has been raised from two points of view : a) acceptance of contraception has a distinct age pattern, tending to be highest in the age group 25-29 through 35-39 and lowest among younger and older women ; b) fecundability and the length of amenorrhea vary by age, with young women having higher fecundability and shorter amenorrhea than old women. By using estimated parameters for all married women 15-44 these age differentials have been ignored. (in addition, the use of parameters for all women ignores the likelihood that women disposed to accept contraception—the group actually considered by the model—are more fertile than the average for all women, even within age groups.) Overlooking the age differences could be a pro--blem if the age-specific parameters were sufficiently different to cause a shift in advantage from one strategy to another.

With respect to the first issue there seems to be little problem. Acceptance tends to cluster in the older age groups. Fecundability is lower and amenorrhea longer in these groups. Therefore, the relative advantage would tend only to shift even more in the direction of long T strategies. These are already the strategies recommended using the parameters for all age groups, so no change in approach is required to tailor the programme for the needs of the groups most likely to use.

The second issue would be important if it were thought desirable to give different recommendations to different age groups. This requires further analysis, since it is possible that the higher fecundability and shorter amenorrhea of young women may produce a shift in relative advantage toward short T strategies for these groups. Age-specific data are available only for the level of fecundability, which has been raised slightly to approximate the characteristics of young women. These results are presented in Table IV.

TABLE IV

MEAN MONTHS ADDED TO THE INTERVAL TO NEXT CONCEPTION BY ACCEPTANCE STRATEGY AND MONTHLY DISCONTINUATION RATE FOR YOUNG WOMEN

Acceptance Strategy	Monthly Discontinuation Rate, d			
	.0838	.0561	.0289	.0119
Postpartum (Fixed T=1)	2.8	6.0	16.0	39.9
Fixed T=6	4.0	7.6	17.9	41.3
Mixed T=6	4.2	7.6	18.2	42.0
Fixed T=18	5.2	8.4	16.7	34.0
Mixed T=18	7.5	11.7	22.4	44.7
Postamenorrheic	9.4	13.5	23.5	44.0

Other Assumptions : $e=.95$, $f=.15$, $h=18.9$, $\lambda=.7$.

Even with fecundability increased 50 per cent, the long T, mixed and postamenorrheic strategies remain the preferred approaches, assuming the low continuation rates believed typical of Bangladesh. Indeed, even if discontinuation is reduced to the lowest level, the long T strategies retain a slight advantage, although the relative advantage of these models gradually declines.

Moreover, note that for all discontinuation rates the advantage for the long T strategies relative to the short T is less when natural fecundability is higher. This again is because the proportion of women conceiving prior to acceptance increases. Finally, for the lowest discontinuation rate, the proportion of women receiving at least some protection increases sufficiently for the short T strategies to approach the efficiency of the long T models.

Inclusion of shorter amenorrhea for young women would further reduce the advantage of long T models. However, even with this further adjustment it is likely that the preferred strategy for young women would remain the mixed, T = 18 or postamenorrheic. This is particularly true if, as is widely believed, young women have lower continuation than the average of all acceptors.

VII. LACTATION

The possible effects of pill use on lactation were mentioned briefly at the beginning of the paper. Some research has indicated that use of oral contraceptive may reduce milk flow in breastfeeding mothers. If this is the case there may be two subsidiary effects. 1) The nutrition of children may suffer, especially in a country such as Bangladesh where

supplementation does not begin until at least six months and often as late as one year or more after birth. 2) Reduced milk flow may cause the mother to abandon breastfeeding. Since the pill tends to induce menstruation, when the woman terminates breastfeeding, she will either already be menstruating or will begin very soon. Should the woman then quit using the pill, it is possible that she will be at risk of conception sooner than had she not used the pill and simply enjoyed the normal period of postpartum amenorrhea.

A recent review of the literature on this question claims that only very early use of pills appears to have any impact on lactation, and even this remains in doubt [1]. In Bangladesh, early evidence from contraceptive distribution programmes suggests that, in the aggregate, there is little danger of increasing fertility by truncating amenorrhea. Studies currently being analyzed should provide greater insight into this problem.

In the meantime, the recommended long T, mixed and postamenorrheic rules virtually eliminate the problem of truncating amenorrhea. They also minimize the possible adverse effects on infant nutrition. However, until this question is better understood, it would probably be wise to make contraceptives other than the pill available for women who begin to menstruate less than 6 months after giving birth.

VIII. SUMMARY AND CONCLUSIONS

The data presented here suggest that the long T, mixed or postamenorrheic models are the most appropriate strategies of acceptance, given the current situation in Bangladesh. Because of low natural fecundability and long amenorrhea, the long T strategies remain the most advantageous irrespective of the level of discontinuation. Even when natural fecundability is increased to reflect the characteristics of young women, the long T approaches remain the best.

In selecting between the long T, mixed and postamenorrheic strategies there may be some administrative advantage to the mixed T approches. However, it must be remembered that either approach relies heavily on regular (preferably monthly) visits by a conscientious fieldworker to ensure that women begin contraceptive use immediately after their first menstruation or in the designated month postpartum.

The estimates persented can only approximate reality because the values assigned to the critical parameters refer to all married women 15-44

years of age, rather than to the subsample of women disposed to use contraception, and age differences have been ignored. Still, the long T models fit virtually all expected combinations of values. Therefore, refinements in estimated values to deal with these problems would be unlikely to change the recommended strategy.

The only factor that might be present and could influence choice of strategy is procrastination. Preliminary impressionistic findings from an experimental contraceptive distribution programme suggest that the social nature of acceptance may result in enough procrastination to shift the absolute advantage to the short T model. Further research is necessary to evaluate this possibility.

Finally, it is important to realize that improving continuation rates has a far greater impact on the number of months of protection gained from contraception than does the choice of strategy. Furthermore, improved continuation reduces the differences in efficiency between strategies, thus making selection of the "correct" strategy less critical.

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Appendix

Model for Estimating Efficiency of Acceptance Strategy

The following is a brief description of the model used to evaluate alternate strategies for beginning contraceptive use. A more detailed discussion of the model and formal proof of the equations involved is available in [5].

The efficiency of an acceptance strategy is measured by the mean interval from childbirth to next conception, M, including into the average those women who conceive before the prescribed time for acceptance. In the absence of contraception, the expected interval from childbirth to next conception is the mean length of anovulation plus the average number of fecundable months required for conception under natural fecundability f, or, in symbols, $h+1/f$. If $\triangle$ is the months added to next conception by contraception over the duration to be expected in the absence of contraception, then M equals $\triangle+h+1/f$; and, equivalently, $\triangle=M-h-1/f$.

Contraception can delay the next conception only if practiced during one or more fecundable months. Among postnatal women, two groups of women fail to benefit; those who conceive before the prescribed time, T, for acceptance, and those who accept during anovulation but discontinue before its end and whose practice therefore entirely overlaps with anovulation. When contraception is accepted during a fecundable month or accepted during anovulation but continued into the fecundable period, the expected number of fecundable months to conception can be shown to be $\frac{1}{d+p}+\frac{d}{d+p}\left(\frac{1}{f}\right)$, which exceeds 1/f, the number expected without contraception, by the amount

$$C=\frac{1}{d+p}-\left(\frac{p}{d+p}\right)\frac{1}{f}.$$

It may be anticipated that, of two strategies, the one having a greater proportion of postnatal women benefiting from contraception will produce the larger value of $\triangle$.

Mean months added by contraception to next conception, $\triangle$, is directly related to the proportion of postnatal women benefiting from contraception. Under any strategy the women divided into P_c, the proportion who conceive

before accepting, and P_a, the proportion who accept. Of the latter, P_α accept during anovulation and P_f accept during some fecundable month. Among the P_α, P_x extend their practice of contraception into the fecundable period, whereas $P_\alpha - P_x$ have their entire segments of contraception coinciding with anovulation. It follows from these definitions that $P_f + P_x$ benefit from contraception, while $P_c + (P_\alpha - P_x)$ do not. It has been shown elsewhere [5] that, under the assumptions adopted,

$$\triangle = (P_f + P_x)\, C = \{1 - P_c - (P_\alpha - P_x)\}C.$$

Thus, for any given set of fecundity and contraceptive characteristics, the strategy that yields a greater proportion benefiting—or, what is the same, a lower proportion not benefiting—yields a higher $\triangle$.

A straightforward argument supports the assertion that low-T strategies are favoured by shorter anovulation, higher fecundability, better continuation, and a higher proportion of ovulatory first menstrual cycles. Consider for the class of fixed duration strategies how $\triangle$ varies as a function of T when the set {h, d, e, f} is fixed. C, the expected lengthening of the interval to next conception among benefiters, is independent of T ; but proportions P_α , P_c , and P_x all vary with T. As the prescribed time for acceptance, T, is increased, P_c , the proportion who conceive before acceptance, tends to rise while $P_\alpha - P_x$, the proportion who experience only overlap between contraception and anovulation, falls. Indeed, $P_c = 0$ for T equal to or less than the minimum length of anovulation, but it increases monotonically to 1.0 as T is made very large. From an initial value of 1.0, the proportion accepting during anovulation (P_α) falls monotonically with rising T, and necessarily $p_x \leq P_\alpha$.

Let ${}_F T_{max}$ be the value of T which optimizes the fixed duration strategy for the given set of fecundity and contraceptive parameters. Anything that makes P_c rise more rapidly, other factors being equal, will tend to make ${}_F T_{max}$ smaller. Conditions favouring a more rapid increase of P_c are shorter anovulation and higher natural fecundability, f. At the same time, anything that makes the initial value of the overlap group, $P_\alpha - P_x$, smaller, and therefore, having less distance to fall, also works to make ${}_F T_{max}$ smaller. Contributing to this effect are shorter anovulation and

higher continuation, the latter because P_x/P_α is thus rendered closer to 1.0.

An analogous set of relationships holds for the class of mixed strategies and ${}_M T_{max}$. An additional relevant factor is λ, the probability that the first cycle is ovulatory. A higher value of λ tends to favour a lower ${}_M T_{max}$ since it increases the rate of rise of P_c while not affecting $P_\alpha - P_x$.

For T greater than the minimum length of anovulation (i.e., $T>1$), the mixed strategy produces a larger $\triangle$ value than the corresponding fixed duration strategy. This follows because, for any given $T>1$, the two strategies share the same value of $P_\alpha - P_x$, but P_c is always larger for the fixed duration than for the mixed strategy.

Further, from the fact that P_c rises more rapidly as a function of T under the fixed duration than under the mixed strategy, it follows that ${}_M T_{max} \geq {}_F T_{max}$. Equality obtains only when T equals or is less than the minimum length of anovulation.

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Articles

Transition to Collective Agriculture and Peasant Participation—North Viet Nam, Tanzania and Ethiopia

by

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Revolutionary central leaderships usually desire agrarian transformation from individual to collective agriculture from out of macro perceptions not initially shared by the peasantry. This paper seeks to understand, from a comparative study of experiences in North Viet Nam, Tanzania and Ethiopia, what are the possibilities and policy issues for achieving peasant participation in such transformation. The study suggests that there must be evident material compulsion for the peasantry to voluntarily adopt collectivism. But this is not enough. Natural inclination of the peasantry under such circumstances towards co-operation in production may be destroyed by an attempt to force the pace of transition to collectivism. What is needed is a careful strategy of steering the peasantry through progressive *praxis* in collective agriculture, in which co-operation in production develops organically as a productive force in terms both of peasant motivation and their capability for managing the complex collective tasks. There is thus an evolutionary stream in participatory transition to collective agriculture. This at any stage should be more advanced the earlier it starts, and it is never too early to begin, even before a macro-political change takes place.

I. INTRODUCTION

The purpose of this paper is to seek illumination on the question of *participatory* transition to collective agriculture by way of comparing the experiences of North Viet Nam, Tanzania and Ethiopia, drawing upon

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*The author is associated with the Rural Employment Policy Research Programme of ILO, Geneva. An intensive discussion with Amit Bhaduri on his Viet Nam study and on Justin Maeda's Tanzania study generated a number of the insights observed and developed in this paper. Detailed comments from Dharam Ghai and Reginald Green on an earlier draft of this paper considerably enhanced the author's understanding of the Tanzanian

(Contd.)

recent ILO case studies on these three countries.[1] The term "collective agriculture" is used to include all transitional forms of collective farming in a policy of full transition to collective ownership (or "possession") and management, and includes the final stage in the transition specifically referred to as "communal farming". Participatory transition is conceived, firstly, as a process of voluntary adoption of collective agriculture by the peasants. This may be steered by an external leadership by way of educative efforts, guidance, persuasion, designing special incentives, etc., but not "forced" by way of legislative compulsion or authoritarian direction. It implies, secondly, participation in any stage of the transition—i.e., active involvement of the peasants in the collective tasks they have undertaken to perform.[2]

The analysis in this paper is concerned with the peasant responses to and the contradictions generated at the grass-root (micro) level as a result of initiatives undertaken by national leaderships to transform the agrarian scene. Such initiatives are prompted, one assumes, by macro perceptions about the course of development under alternative strategies which see the need for collective agriculture to avoid excessive economic and social differentiation that the pursuit of individual agriculture may generate, to facilitate the adoption of large-scale technology for rapid agricultural growth in an egalitarian framework, to promote the generation of agricultural surplus and its use to meet the collective needs of the society, and above all, to

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(*Contd.*)

problematic and resulted in substantial revision of the draft. Comments from Samir Radwan, Guy Standing, Peter Peek, Ajit Guha, Zubeida Ahmad, Alula Abate and Ahmad Kamal were also useful in finalising the paper. Needless to say, the author alone is responsible for its inadequacies.

[1]These studies are Bhaduri [3], Maeda [12], Ghai and Green [9], Abate and Teklu [1]. Use has also been made of the proceedings of a workshop held in Arusha in April 1979, reported in [8]. The studies by Bhaduri, Maeda and Abate-Teklu are part of the ILO's recent Programme on Participation and organisation of the Rural Poor and will appear in a forthcoming anthology [4].

Amit Bhaduri visited all agricultural co-operatives in North Viet Nam in 1976 ; Justin Maeda studied 26 villages in some 20 districts in Tanzania ; Alula Abate and Tesfaye Teklu intensively studied two *weredas* (administrative unit at a sub-divisional level) one in Southern Ethiopia called *Shashemene*, and the other in Northern Ethiopia called *Dangella* ; the Ghai-Green study is based on secondary data plus a visit by Ghai to three villages. Without claiming any representative status, the insights obtained from these studies and from the comparative analysis done in this paper may be considered as hypotheses that advance the progressive interaction between empirical observation and the enunciation of theoretical relationships.

[2]Participation is a social aspiration that is believed to be widely shared. Participation is also a means for mobilising initiatives and resources for economic and social development. For a fuller conceptualisation of the notion of "participation" guiding the ILO's current work in this area see [11].

further the ideological objective of over-all social transformation. Such macro perceptions may emerge from the concrete experience of exercising macro responsibility, or from being involved in macro policy analysis, which are not usually shared by the masses of the peasantry who may not therefore develop such perceptions easily. A "consciousness gap" is thereby created, becoming the main problematic in a participatory transition to collective agriculture that is centrally initiated. The present paper seeks to understand what in such a context are the real possibilities of motivating the peasantry in a transition to collective agriculture so as to obtain their maximum participation in the process, and what are some of the policy issues in such a transition.

II. THE GENERAL SITUATION REGARDING TRANSITION TO COLLECTIVE AGRICULTURE, AND PARTICIPATION

North Viet Nam

Of the three countries studied, the state of transition to collective agriculture is by far the most advanced in North Viet Nam. By 1976, ninety per cent of its cultivable area was under the "co-operative sector" with predominantly high level co-operatives characterised by collective ownership of land. Low-level co-operatives where land is privately owned while farming operations are conducted collectively have by now become rare. The scale of co-operatives also has increased, through merger of low-level co-operatives in the process of their transition into high ones thus facilitating the application of large-scale technology. The process of co-operativisation and its qualitative development over time, i.e., the transformation from "low" to "high" level co-operatives has been gradual, and agricultural production has not suffered in this process in its early phase.

The co-operative movement in North Viet Nam has asserted throughout the principle of voluntariness ;[3] while deviations have been committed by some cadres, the principle has on the whole been adopted, and its application monitored, seriouly. The freedom not to join a co-operative, and the right to leave one, have always existed and in the difficult early years of the movement some 1.6 per cent of the total number of member households are reported to have actually left.

By 1976, the co-operatives in North Viet Nam are seen to have a high level of member participation. Production and capital construction works are organised through work teams consisting of anything between 10 to 200 workers, led by an elected head and deputy head. Regular meetings of the work teams are held for production planning, the distribution of "work points" and other related matters. Perhaps the most significant

[3] Cf. Edwin E. Moise [13, p. 88].

participatory content of North Viet Nam's co-operative agriculture is the total involvement of the membership in the distribution of the income from a co-operative among its members. This has developed into a highly personalised system : the General Assembly of all co-operative members fixes the number of working days for every member, taking into consideration the personal conditions (e. g., health, pregnancy, etc.) of each member and the type of work to be performed. The managing committee prepares a list of types of work and the "work points" to be allotted to each type of work, to be discussed and approved also in the General Assembly. The marking system varies considerably among co-operatives. The "work points" constitute "norms" with reference to which individual performance is assessed by the head of a work team who proposes work points for each team member individually ; these are to be discussed and approved in the General Assembly and for this the head's proposals are required to be made public at least a fortnight before the Assembly meets. Such a system of collective involvement in deciding the distribution of the fruit of collective work can indeed be claimed to eliminate the problem of distribution at the grass-roots level as a problem for the state.

North Viet Nam's work point system also has built into it a force against the separation of "labour" from "management", in that the work point for managerial work is always fixed at a level lower than the average work points (and hence income) earned by the members so that the managing committee members are unable to earn average income or more without working as members of the work teams as well. The more homogeneous "class character" of the co-operatives which resulted may be claimed to give a firmer basis for the attainment of participatory democracy at the grass roots.

Apart from inter-personal distribution, the distribution of the net income of the co-operative between "consumption" and "investment" (within a legally stipulated range of 5-10 per cent rate of investment), and provision for public welfare funds, is also collectively deliberated and decided in the General Assembly of a co-operative.

In one crucial respect, however, the democratic procedure of decision making in North Viet Nam co-operatives seems to have been abandoned in favour of a hierarchical procedure : the settling of disputes between the chief accountant and manager of a co-operative, or between its audit committee and the managing committee. In the former case, usually both the state and the party organ at the local district level are asked to intervene ; in the latter case there seems to be a dual provision for resolving the dispute either in the General Assembly or by the higher party organs and it is not clear which of the two predominates in practice.

Tanzania

In Tanzania, the Ujamaa village policy promulgated in 1967 sought to establish village clusters with their eventual transformation into Ujamaa communities owning and cultivating land collectively. Initially, villagisation was fully voluntary, relying almost entirely on the peasants' own initiative. After a relatively slow start in 1967/68, President Nyerere's call to "go Ujamaa" was responded to by a big spurt in the growth of villages with some communal farming initiated in many of them. Typically, the establishment of a Ujamaa village involved settlement on new lands, in areas of low productivity with sparse population engaged in subsistence farming.

The early villagisation spurt was followed by a period of lull from 1972, and a nationwide compulsory villagisation programme was launched in 1974—a massive operation in which instances of the use of force to move peasants were not unknown. Through this operation villagisation was virtually completed by 1977. But there was insignificant further progress in the process of transformation of the newly established villages into Ujamaa villages, and official policy itself seems to give precedence to the creation of "development villages" over Ujamaa villages in the short run while keeping Ujamaaisation a voluntary long-run objective. As of now, less than 5 per cent of total agricultural production is estimated to be under communal farming. The political leadership expects that the peasants will ultimately become motivated to engage in collective undertakings until this becomes the predominant mode of production and that this will happen through progressively greater involvement in such undertakings, the acquiring of technical and managerial experience and increasing politicisation. There has indeed been a mushrooming of collective non-farm activities such as small-scale capital works and the setting up, owning and running of shops, grain mills, small-scale industrial enterprises and modern animal husbandry, in many villages ; and such activities are increasing, though not yet rapidly. But in so far as communal farming goes there are as yet no clear signs of progress ; there are signs, on the contrary, of the situation regressing—there is scattered evidence that in some villages communal farms have been redistributed as personal plots, and in some others mounting pressures are reported for such redistribution of land.

A decentralised administrative structure gives considerable powers of collective decision making to the villagers. Naturally, the villagers' participation in the village assembly sessions is relatively high where they have substantial communal undertakings, and participation is higher and more intense when such issues as the distribution of returns from such undertakings are deliberated. The level of sophistication in handling the complexities of the distribution question seems to be low : it is common practice to distribute income from communal work simply according to the number of

days one has participated in such work, without regard to the nature of work and the quality of one's contribution to it. Some bright spots exist, however, in the form of "socialist groups" in some villages, engaged in highly participatory communal production, meeting regularly and frequently for collective deliberation, and some of them having introduced some form of a work point system based on the nature of the tasks performed.

In general, however, the villagers' motivation to participate in communal farming,[4] even where they have pooled some land to be cultivated communally, is low, and such participation is inversely correlated with the size of a family's privately owned plot. In many cases, the relatively wealthy members of such communities earn the lowest incomes from the distributed communal income. As a rule, the better-off farmers have seldom shown much enthusiasm for the idea of communal farming.

Collective tasks are in general poorly managed, with ambitious plans relying excessively on external deliveries which do not all come, or do not come in time. The practice of village assemblies proposing programmes to the government without considering their financial and technical implications is common, thus developing a dependence on bureaucrats and technocrats not conducive to the promotion of participation.

It appears that, on the whole, the movement for collective agriculture and peasant participation in Tanzania is in a rather uneasy state with no strong forces yet visible to propel it forward.

Ethiopia

Even in five years (1975-80) Ethiopia's experience in the transition to collective agriculture has been quite intense. In Southern Ethiopia the end of feudalism in 1975 came through a land redistribution that created a system of peasant proprietorship. A process of co-operativisation was thereafter initiated which envisaged a gradual transformation from service co-operatives to "elementary form of producers' co-operatives" in which 75 per cent of land would be possessed and farmed collectively and farm implements would be pooled while their owners could be paid for their use ; and finally to "advanced producers' co-operatives", with at least 90 per cent of land and all assets collectively owned. To implement both the land reform and co-operativisation programmes the peasants were to be organised into peasant associations under the leadership of the poor and middle strata of the peasantry. To assist in this whole process, some 60,000 senior secondary school and university students, officials of the Land Reform Ministry, and the army were deployed in the villages in a campaign known as the *Zemecha* (or "Development through Co-operation").

[4]The Arusha Workshop Report [8, p. 59] observes a low level of commitment to collective undertakings in general in many villages.

In 1975 and 1976 there was spectacular expansion of communal farming in the Shashemene Wereda studied, in the initiation of which the "*Zemecha* participants" played a major role. But immediately after the departure of the *Zemecha* participants, starting in 1976, communal farms abruptly declined in size, and after 1976 a number of peasant associations completely abandoned communal farming.

Like Viet Nam, the Ethiopian leadership also asserted the principle of voluntariness in co-operativisation. Initially, some voluntary joint farming in some areas had actually started spontaneously, where newly formed peasant associations pooled their labour and land and tilled collectively to preempt the danger of failure in crop production. In other cases the *Zemecha* participants divided the peasant associations into groups for joint cultivation of the land of each of the group members separately—a first step in the *praxis* of collective farming. But by and large the *Zemecha* participants appear to have been rather over-enthusiastic about the transition to collectivism, and in places are reported to have used authoritarian methods (e. g., ordered the peasant associations) to promote full-fledged communal farming. This went to the extent of "ordering" some associations not to give more than a hectare of private plot to each member, ignoring the Government's own directive about maximum ceiling which was set at 10 hectares. Even the formation of peasant associations as a necessary component of the land reform-cum-co-operativisation programme, was in some cases attributed by the peasants to orders from the *Zemecha* participants which they simply obeyed.

The management of communal farming has been crude. Only house hold heads were required, apparently by central policy, to work in the communal farms, and the product was to be distributed in proportion to work performed by them. This put the larger families at a relative disadvantage with repect to earning from communal farms, and many of them stayed hungry as a result. In some peasant associations even this (socialist) principle of distribution according to work was not followed, and members were given the right to equal share irrespective of their contributions to the communal product—an internal decision of the associations.

Generally, communal plots were fragmented, and also located in less fertile or more hazardous areas not considered suitable for personal plots. Fragmentary data indicate that the general level of participation in communal work required of the household heads is falling—in 1978/79 the rate of absenteeism reached 40 per cent. Executive committees, whose members typically supervise but do not participate in production of the communal farms, adopt various measures ranging from warning to imprisonment to check absenteeism. Corruption among executive committee members has been high, and for this they are being changed frequently ; but in most cases the initiative to change

the leadership of peasant associations had to come from the Government to whom the membership petitioned against their leaders rather than changing them themselves which they are authorised to do.

On the whole, the peasantry in the area studied do not yet show any positive attitude towards communal farming. They wish to become masters of their fate as individual proprietors, and view the basic unit of production to be the small family farm.

In Northern Ethiopia land reform was not carried out initially due to a misconception that the communal ownership of land traditionally prevailing there implied communal farming as well, whereas land was actually being tilled individually under individual possessory rights. The task of the peasant associations was seen only as the promotion of co-operatives. The co-operatives that were formed were all service co-operatives, dominated by the richer farmers with the poor disinterested in them. The mistake was corrected in 1978 when new elections of the peasant associations' leaders were held in a bid to elect the leaders from among the poor and middle strata of the peasantry. A process of land redistribution through the associations was initiated that was completed by mid-1979. This resulted in a proliferation of holdings of sub-optimal size. The poorer peasants also had difficulty in operating their newly gained farms because of lack of implements. In the Dangella area studied, peasant associations encouraged them to pool their land and to work collectively, while others organised members into small teams to work collectively on each other's individual holdings, with farm implements and draft animals contributed by those team members who had them.

Some communal farming—on a very small scale and on fragmented plots—has started in the Dangella Wereda. The poor peasants lacking enough farm implements and livestock initiated communal farms in some places, but many others were imposed upon the peasants by the local administration, with the local agricultural office even deciding on the utilisation of the produce from the communal farms. An elementary producers' co-operative has emerged in one area in September 1978 initially with 142 households and 70 pairs of oxen, to come down to 48 households by mid-1979 with 19 oxen remaining ; the richer farmers did not find it advantageous to work in such co-operation with poor peasants and started withdrawing with their land and oxen.

III. THE CONTEXTS

Historical Roots

In understanding the differential experiences in the three countries it should be noted that the Vietnamese co-operative organisations had their roots in the war with France even before the land reform programme of

1954. By 1949 more than 20,000 mutual aid groups and 4,335 full-fledged co-operatives had already been created in the areas under the control of the Viet Minh,[5] explainable more than anything else by the sheer compulsions of survival and sustaining the war. Neither Tanzania nor Ethiopia has a comparative history of foreign oppression and mass resistance against it. The majority of the Tanzanian peasantry lived a relatively uneventful life in scattered homesteads or hamlets of two to five families and many were pastoralists with seasonal residential rotation patterns. While poor, they had a relatively low level of socialisation[6] and were not being socially oppressed. Because of this and other factors which we need not go into here, no serious social urge for a change among the Tanzanian peasantry was apparent. Some experiments in village settlement and communal farming had been pursued by the national leadership in the years preceding and following independence, but these were of a relatively isolated character in which the degree of active peasant involvement is not known.

Serious class oppression of the peasantry existed in feudal Ethiopia and various forms of peasant movements and uprisings are recorded in its history. These, however, rarely resulted in well-organised resistance which could have stimulated economic co-operation among the peasantry for its sustenance. A tradition of communal farming existed in the past in Southern Ethiopia which has not been adequately studied. Policy makers in the country generally consider this to be the basis for the current drive for collective farming. In Northern Ethiopia, peasants who possessed land but insufficient farm implements or livestock or who possessed the latter but had insufficient land had a tradition of combining in various forms the land, farm implements, oxen and labour, sharing the crop according to customarily prevailing arrangements. As we have noted, after the land redistribution of 1978/79 spontaneous co-operation of this nature has also been emerging in Dangella among the poorer peasantry facing similar difficulty in pursuing independent farming.

Initial Conditions

The formal co-operativisation programme in North Viet Nam came after the land reform of 1953-56. The policy of the land reform was, as is well known, to "rely fully on the poor peasants and agricultural labourers, unite with the middle peasants, ally with the rich peasants, and overthrow the landlords".[7] The landlords' land and some other assets were confiscated and

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[5]See Alexander Woodside [14, p. 707].

[6]Apart from some traditional forms of mutual co-operation such as hut building, harvesting, etc.

[7]See Moise [13, p. 73].

distributed to the landless and poor peasants and some of the middle peasants. It is important to note the serious land scarcity in relation to the peasant population : the average holding was less than half a hectare. What are called middle peasants were basically self-sufficient smallholders, and the effect of land reform was essentially to create a large mass of tiny holdings offering only subsistence livelihood under individual family farming.

Tanzania presented quite a different picture at the time the Ujamaa village policy was first initiated. The average farm size was in the neighbourhood of 1.7 hectares, and a substantial land frontier existed that could be exploited through irrigation and flood control to increase the cultivated area by about 40 per cent. The typical small peasant family probably cultivated about 0.5 to 2 hectares, the typical middle peasant 2 to 7 hectares, and perhaps the 50,000 "proto kulaks" (employing at least one year-round employee) 5 to 25 hectares. The last group had been gaining social strength largely through its control over (service) co-operatives and links with government officials, and in some areas these emergent capitalist farmers had been able to acquire some concentration of control over better quality land by manipulating the communal land allocation system. The land distribution associated with villagisation particularly in its second phase brought down the landholdings of these proto-kulaks who lost power also due to the abolition of the previous co-operatives and the formation of village councils. The post-villagisation land distribution became remarkably egalitarian on the whole. However, the situation is not uniform in this regard, and in some villages there continues to be considerable degree of economic differentiation caused both by unequal land distribution and private ownership of productive non-farm assets (e.g., livestock, tractors).

Like North Viet Nam, land reform in Ethiopia also created a system of peasant proprietorship with little by way of a "land frontier". Peasant associations were empowered with the task of distributing land to persons willing and able to cultivate, on the basis of equity, considering both the size of family and the quality of the soil, within a ceiling of 10 hectares per family. This brought down the existing disparities in landholding considerably, though inequalities still remained. Between peasant associations the land/man ratio was determined by whatever land was under command of the respective communities prior to reform, and this created rather wide differences in the average land holding per capita by associations. Within peasant associations kinship and clan loyalties stood in the way of equal treatment in land distribution, and this was compounded by corruption of association leaders and to some extent also by imprecise techniques used to measure plots. Thus landholding size varied, for example, from a quarter to 2 hectares for single members in the Shashemene Wereda. Furthermore the quality of land was seldom considered in the distribution so much so

that some members in many peasant associations were forced to take virtually barren land.

In the north, as already noted, land reform had not been carried out when the co-operativisation programme was first launched.

IV. THE DIALECTICS OF TRANSITION

The Challenge of Leadership

The vision of collectivist transformation of agriculture apparently came in all the three countries from the top—i.e., from the central leadership. A question of bridging the "consciousness gap" for a participatory transition to collectivism was therefore present. With the experience of its peasantry in collective mobilisation and differnt forms of co-operative production during the liberation war, and the close integration of the party with them, this gap must have been considerably lower in North Viet Nam than in Tanzania or Ethiopia. It appears that in the more systematic transition to collective agriculture since 1956 the North Vietnamese leadership defined their responsibility as providing a sense of direction to the peasantry, working out a rational strategy for the transition particularly with respect to its staging and the question of economic classes, and steering the co-operative movement which by and large retained a voluntary character.

In Tanzania the leadership's initial call to "go Ujamaa" found a response among poor new settlers. But when villagisation was made compulsory those Tanzanian peasantry who had their option (to villagise) earlier but had not been stimulated to do so themselves, must have accepted it now either resentfully, or passively, or in the expectation that the Government which was taking such a major initiative to change their lives would continue to look after them. Whatever the specific psychology may have been, one would expect alienation to have resulted, in the sense of a detachment from one's own initiatives and powers, i.e., from self reliance—in other words alienation from participation itself. To be fair, it may be recalled that previous to this there was hardly any social participation among the unsocialised peasantry, although there may not have been any alienation either in their traditional mode of living in which the initiative to act was all theirs. In any case, the leadership's aim was to generate real social participation through the villagisation programme. Without judging the merit of this move one may note the dilemma that it implied—namely that in order to promote participation the peasantry first had to be alienated. Having done this, the next move also belonged therefore to the leadership rather than to the peasants.

The move chosen by the leadership was to keep the Ujamaa as a long-run objective in the hope that the peasants would ultimately "go Ujamaa"

but, as it appears from the Ghai-Green study, to shelve it as an operational concept for formulating current strategy which was oriented around the concept of "development villages" with the thrust on the delivery of resources and expertise from outside.[8]

In Ethiopia one sees almost the opposite. Notwithstanding the State's policy of adhering to the principle of voluntariness, it appears that the pace of collectivisation was pushed beyond the peasants' psychological readiness for it. The peasantry were alienated as a result and did not take communal farming (economic participation) seriously, as evidenced both by the high rate of absenteeism in communal work and the large-scale withdrawal from communal farming as soon as the *Zemecha* participants left. The alienation is also reflected in the fact, observed in the Abate-Teklu study, that there was greater enthusiasm in general in the peasant associations to discuss issues directly concerning "local administration and the prompt delivery of government resources"—i.e., what the Government could do for them rather than what they could do for themselves.

Staging

In all three cases the leadership has recognised, in principle, that the transition to full collectivism may best be evolutionary, progressing from "lower" level co-operation to "higher" levels. The operational conceptualisation of this evolution has, however, differed. In North Viet Nam a three-stage transition was conceived, preceded by pilot schemes of co-operatives, with each stage linked to the next one in a dialectical sequence with classical Marxist logic : mutual aid generates and develops co-operation in production whose success as well as the barriers to its fuller development was supposed to create the urge for greater co-operation in production represented by pooling of land for collective farming under private ownership—a change in production relations ; in turn the success of collective farming as well as the obstacles that this newly released productive force encountered in the way of its fuller development was expected to create the urge for doing away finally with individual ownership. The participatory nature of the North Vietnamese transition to collective agriculture demonstrates that this logic has some validity.

In Tanzania President Nyerere envisaged three distinct stages in rural transformation. The first stage was villagisation. In the second stage each village would initiate communal undertakings in an "embryonic" form. In the third and final stage the villagers would be persuaded of the superiority of the communal economy and would adopt predominantly communal farming with private farming as a marginal activity. From the fact, however,

[8]The strategy of deliveries from outside prevailed in the pre-1974 phase of villagisation-cum-Ujamaaisation also ; after 1974 this strategy, however, seems to have taken a priority over Ujamaaisation.

that some communal farming was started in the very first stage straightway, and that otherwise the growth of communal activity has concentrated in the non-farm rural economy with little progress in peasant co-operation in farming, it appears that no clear strategy of an evolutionary transition to communal farming was envisaged. Almost as a corollary, and unlike North Viet Nam, transition to collective agriculture in Tanzania is not being steered, except for "political education" of a general character unrelated to any systematic progressive *praxis* in collective agriculture.

The Ethiopian case looks like one of over-steering, at least initially, by the over-enthusiastic *Zemecha* participants, in the course of which intermediate stages as conceived have been skipped. But even the conception of staging as such may be questioned from the point of view of its inner logic. Service co-operatives are a different qualitative category from production co-operatives and have nothing to do with developing co-operation as a force of production. It has therefore no sequential relation with collective or communal farming and there is no reason (by Marxian logic or otherwise) why it should, by its own endogenous propulsion, lead to either of the latter. Service co-operatives abound in the world with nothing to do with transition or otherwise to production co-operatives. In Ethiopia itself, there is no evidence that having formed service co-operatives first has given any peasant association an earlier start in terms of transition to producers' co-operatives. In fact, the Proclamation of 14 December 1975 calling for the formation of agricultura co-operatives itself came close to recognising the irrelevance of servicel cooperatives as a forerunner in the transition to collective agriculture by requiring that for registration of service co-operatives the concerned peasant association must have "a firm programme leading towards formation of a producers' co-operative"—an exogenously imposed condition seeking to generate the formation of producers' co-operatives as a separate question.

If service co-operatives were not a logical first step to producers' co-operatives, the "elementary form of a producers' co-operative" as defined, with at least 75 per cent of land to be possessed collectively, may be seen as a major initial jump to communal farming without necessarily passing through any prior *praxis* in co-operative production. The difference between the elementary and advanced forms of producers' co-operatives as defined was to be a matter of quantity, and not quality, as far as ownership of land, perhaps the most important economic asset to the peasants, was concerned In this sense the Ethiopian strategy of transition to collective agriculture fails to satisfy the necessity of communal farming evolving out of the endogenous logic of a co-operative process which might require steering but not any imposition. To be fair to the *Zemecha* participants, one may perhaps understand their confusion in the absence of clear central direction as to how the transition could be steered without violating the principle of voluntariness

Another dimension of the question of staging—the relation between co-operative and individual production in the process of transition to collective agriculture—will be discussed in section titled "The Separation of Collective from Individual Production."

Class Contradictions and Class Strategy

It is of singular importance to note that in none of the three cases have the relatively rich peasants (current, or former) made much impression as voluntary participants in the movement for co-operative production. In North Viet Nam they were, of course, immobilised in any case by a strategy of combining class struggle with the co-operative movement which explicitly relied on the initiatives of the poorer peasantry. In Southern Ethiopia also there was a clear strategy of relying on the poor to middle peasantry for leadership in peasant associations although rich peasants could become members. However, in actual practice in Shashemene the socio-economic backgrounds were often ignored in electing the leaders (members of the executive committees), and what with traditional kinship and clan loyalties, respect for administrative skill and capacity, etc., relatively rich peasants including moneylenders did get elected in some peasant associations in the initial stages. As noted already, initial leaderships had to be changed. In addition to aggrandisement of personal wealth and abuse of power and authority, the major charges against the initial leaders included, according to the Abate-Teklu study, "indifference to the promotion of communal farms···and failure to promote the political consciousness of the peasantry"[1]. The inclinations of rich peasants, however, come out more sharply in Northern Ethiopia where, because of an initial misconception as we have noted, no "class-strategy" was considered necessary, the "traditional local rulers, elders, landlords and well-to-do peasants" captured the leadership of most of the peasant associations in the area studied, and got involved in developing service co-operatives only from which the poorer peasants received little economic benefit. As might have been expected, in both North Viet Nam and Ethiopia the rural rich bitterly resisted the land reform and moves towards agrarian transformation as long as they could.

In Tanzania also no "class-strategy" has been considered necessary, either with respect to the village governments or transition to collective agriculture. To be fair, no significant "class exploitation" within the village is known in the country with the rural rich as a class insignificant in number. But as already observed, significant economic differentiation does exist in some villages, and both the Maeda and Ghai-Green studies observe that the disinterestedness in communal production has been particularly evident on the part of the relatively better off peasantry.

The reason should be easy to see. Well-to-do peasants have the means to pursue their aspirations individually and having become richer than others

through individual effort are naturally attached to individualism as a philosophy of life. They have no compelling material reason to surrender their acquisitions for collective use in which they may see themselves giving more than they would get. This is likely to be true not only before land reform but also after—even if they are brought down in terms of land-owning status and other physical assets, their acquired experience and skills cannot be taken away, and with this they may still expect to do better than others by working alone.

The Advantage of Co-operative Production for the Poor

The evidence is clear from all the three studies that to the extent that co-operative production has been initiated spontaneously by the peasants or in any case voluntarily (admitting external guidance, or persuasion, but not coercion), the initiative has come predominantly from the poor peasantry. The immediate reason for this—the lack of adequate means for viable individual farming—has already been referred to. More fundamentally, the relative advantage of the co-operative system for the poor peasantry is a question of basic security of life, a factor that comes out clearly in the study of North Viet Nam co-operatives.

The basic achievement of the co-operative system in North Viet Nam lies in assuring the provision of staple food, health, education, old-age security, etc. for all people thus offering a kind of *minimum distress insurance* to every individual not usually recognised in efficiency comparisons of individual and collective agriculture.[9] This is an arrangement that could not possibly be matched under a system of individual farming at least at the present level of the country's economic development, and must be the chief economic attraction of the co-operative system. Once this advantage is perceived it should be fully rational for the poor peasants to want to pool resources and subject to efficient management of the co-operatives, to stay there until at least their staying power as individuals has advanced sufficiently. On the other hand the rich, with a staying power already acquired, do not have such material compulsion to join a co-operative.

It is for this reason that, quite independently of whether significant class exploitation exists in the countryside or not, a differentiated peasantry

[9]In another ILO study in the participation programme on an informal participatory system of the "Torrante", a stratum of rural migrant workers in Chile, Gonzalo Falabella observes the practice of these workers giving away their occasional extra income to the most needy among them. The reason, one may suggest, is similar—such occasional extra income does not offer an individual any real increase in his staying power while the Torrante sees in the practice of sharing of his hard earned extra income an insurance which may protect him in his own hour of dire need. See [6].

has non-homogeneous interests vis-a-vis the idea of pooling resources. This fact was implicitly recognised in the initial Ujamaaisation strategy in Tanzania which as we have noted actually concentrated on moving the poorer peasantry into Ujamaa villages—since, as Maeda observes, "it appeared easier to regroup the peasants in these areas probably because·· the social and economic differentiation in most of the communities in them was relatively less developed to act as a barrier to co-operative organisation"[12].

It may be suggested that, in those villages where the peasantry remain significantly differentiated, this may constitute a serious obstacle to progress towards collective agriculture if decision making in this regard is left to the village councils where the richer peasantry are able to dominate. In such villages the poorer peasantry should be encouraged and enabled to form separate decision-making forums of their own and to introduce any form of co-operation in farming among themselves independent of the richer peasants.[10]

Management and Incentives

The Ethiopian experience sharply demonstrates, however, that the mere adoption of a correct class-strategy is not enough. There is a real question of efficient management and serious handling of the incentive question in collective agriculture in order to realise the potential advantage of this system. Without this the movement may well swing backwards.

Experimentation in communal farming on relatively infertile and hazardous land is not a serious proposition. The arbitrary policy of restricting work on communal farms to heads of family also appears to have been a mistake from the distributional point of view. Actual distribution in some communal farms was cruder, as already noted, and inequitable. In contrast to North Viet Nam, where the irrigation technology was closely related to the co-operative movement so as to increase the scale of production as co-operatives moved from low to high levels and merged in the process to form larger units, the relation between technology and communal farming in Ethiopia so far has been obscure—as Abate and Teklu observe, "Most peasant associations complain that they cannot grow crops of high value, like *teff*, on communal land, because large-scale farming without a corresponding level

[10]This point has featured prominently in recent evaluations of the Small Farmers' Developmet Programme of Nepal in which small farmers and landless rural labourers are being motivated to form groups for receiving institutional credit under group liability and develop economic and social co-operation. The evaluations, both by a FAO team and the APROSC of Nepal, observe the difficulties caused in consensus formation by the unintended inclusion of relatively rich farmers in some areas, and recommend careful household surveys prior to group formation in order to ensure that only the poor are in the groups. See [2 ; 5 ; 10].

of technology is impossible with certain crops"[1]. Finally, the output of communal farms has been subjected to a number of onerous deductions (e.g., state taxes, payments for government services etc.) before being distributed for consumption, thus reducing their relative attractiveness even further.

Ghai and Green observe that in Tanzania also "often Ujamaa villages were set up in disregard of such crucial factors as soil suitability or nearness to water"[9]. The time required for travel to and from the communal farm has also been a handicap. The onerous deductions from output of communal farms are there in Tanzania also. The poor management of collective tasks, including handling of the distribution question, has already been mentioned. It is interesting to note that on the question of distribution of communally derived income the leadership itself, as Maeda observes, is seeing a dilemma, i.e., a system of distribution according to work would go against the "socialist principle of equality" whereas by not allowing differentials, the good and fast worker may "get tired of putting his best efforts forward while another member merely does the basic minimum which keeps him in the scheme"[12].[11] Socialists inspired by Marxism do not see the problem in this way and recognise the need for income differentials according to work to provide the necessary incentive until the stage of "communism" has been reached, and would view the above "principle of equality" as an im mediate objective as Utopian at best. In any case, such dilemma seen b y the leadership, if a rational resolution is not found, adds to the difficulty o the peasantry actually to devise a rational distribution system, by failing to provide a clear sense of direction on this crucial question. Finally, in contrast to North Viet Nam in Tanzania the peasants are expected to meet the household food requirement predominantly from personal, and not communal, plots.[12]

All these factors must have contributed to the poor yield of communal farms relative to individual farms in both Ethiopia and Tanzania as observed in the respective studies, directly for physical and technical reasons or indirectly by depressing peasant motivation. In turn, low yield depresses motivation further and so on, creating what Maeda has called a "paradox" i.e., the need for motivation (participation) to promote motivation (participation).

The Separation of Collective from Individual Production

Another factor seems to be playing on peasant motivation as between individual and communal farming—the separation of the two kinds of activities, creating a dichotomy between the two.

[11]Quoted by Maeda from Nyerere, "Implementation of Rural Socialism", 1973.

[12]In Tanzania also collective farms act as a rudimentary social security system for the village with a certain amount of communal production saved in "food reserve" as precaution against poor harvest.

The studies show a very important difference between the strategy of the co-operative movement in North Viet Nam and its counterparts in Ethiopia and Tanzania that must have a crucial bearing on the respective courses of those movements. In both Ethiopia and Tanzania communal production has been, by and large, separated as an activity from individual production from the very beginning, so that the growth of communal production becomes a question of increasing the relative size of such production for each community, whereas in North Viet Nam individual production has been gradually transformed into communal production as a component of the strategy of staging the co-operative movement.

The significance of this distinction from the point of view of incentives is that in the former case the dichotomy constantly poses a question of allocation of resources and effort between the two activities, at every period of time, and one becomes in effect a competitor of the other in the very process of current production. Furthermore, the end performance of one also stands up for comparison with that of the other. It is in this context that, for example, the Tanzanian peasants have been observed to give priority to individual over communal production, with their motivation for working in communal plots observed by Maeda to have been inversely related with the amount of individual plots they possess. The growing rate of absenteeism from working in the communal plots in Shashemene in Ethiopia should also be seen in this particular context.

In the North Vietnamese case there has been no such rivalry in communal production—elements of co-operation in various degrees and forms have been introduced within the individual ownership-based production process itself (until full communal production is achieved) so that individual and collective production have been organically combined. A significant source of tension between the two modes of production has thereby been eliminated, to that extent making a progressive transition from one to the other easier, and more of a natural evolution.

In quantitative terms the above point slightly exaggerates the situation in North Viet Nam—while the transformation from individual to progressively higher level collective production has been organic, some individual production has remained as a separate activity, and this is precisely what demonstrates the above tension most sharply.

In North Viet Nam today, the co-operative system overwhelmingly dominates the agrarian scene, and thereby defines the structure of its agrarian system. Within this structure, however, whatever little private economy exists still appears to be more attractive at the margin with around three times higher productivity per hectare. While at this stage the private economy cannot possibly take over the functions being performed by the co-operative economy as we have discussed, particularly the function of providing

distress insurance, with economic success the notion of distress itself begins to change, and the individual is far more able to protect himself by his own resources and effort. It will be interesting to see to what extent this may affect the long-run stability of the participatory co-operative structure which we see today in North Viet Nam.

V. PROGNOSIS AND POLICY CONCLUSIONS

For North Viet Nam today, the question in collective agriculture is no longer one of transition. In view of the point discussed above, one may speculatively raise the question of its long-run stability. Perhaps the strongest material force in this respect is the man-land ratio, which may very well be decisive in keeping communal farming stable, and rational from both the macro and micro points of view. The hierarchical procedure of settling disputes remains a weakness in the self-reliance of the co-operatives ; the force of this in determining the future course of participation is difficult to assess.

In Tanzania, a long-run goal of Ujamaaisation must have for its realisation a definite strategy of transition and hence its short-run counterpart. If the short-run strategy is to promote communal activity mainly in the non-farm rural economy, it is not clear that this will naturally stimulate eventual collectivisation of farming as well. On the contrary, since independent private farming is not only an economic activity but also a way of life, the longer a tradition of private farming takes root the more difficult it may be to change it. If voluntary Ujamaaisation is seriously held as a long-run objective, one would suggest that systematic effort needs to be made to stimulate progressively higher forms of co-operation in farming. The present uneasy stalemate at a low level of collective agriculture cannot possibly continue indefinitely : either progress in this direction must continue, or the very concept of Ujamaa may be undermined and anti-Ujamaa forces may consolidate.

The question of voluntary transition to Ujamaa is made more problematic if the bulk of the Tanzanian peasantry, able to meet their minimum subsistance needs from private farming and with a land frontier to extend private farming, do not see much of a material compulsion for co-operating and pooling resources in production. This may rationalise a policy of waiting, before another thrust towards collectivisation is given, until Tanzanian agriculture matures for large-scale farming which in an egalitarian framework would imply some form of collectivisation. But it is not easy to see a peasantry habituated in private farming suddenly embracing collective farming without a progressive *praxis* in co-operation in farming evolving into it. From the outside it is difficult to speculate how this dilemma may be resolved; but if the forces identified above do indeed work as they have been assumed to, the problem is a real one.

In Ethiopia evidences of spontaneous emergence of various forms of co-operation in production among the poorer peasantry after land redistribution, with some traditions of a similar nature in some areas before the revolution also again among the rural poor, suggest that a participatory transition to collective agriculture could perhaps be achieved if the process were carefully steered. The leadership seems seriously committed to a policy of reliance on the initiatives of the poorer peasantry for agrarian transformation, and in principle also to voluntariness. What seems to be needed is a strategy of transition that will seek to develop peasant co-operation as a productive force organically in their lives and progressively, in harmony with the poor peasantry's own inclinations to pool resources in view of the material compulsions faced by them, trying to stimulate these inclinations further rather than superimposing advanced stages upon them which at present might be alienating. Whether there exist extraneous time or other constraints to the pursuance of such a course is not apparent. If they do exist, and make such superimposition necessary to hasten the pace of collectivisation, whatever else may be achieved participation is bound to suffer, and collective agriculture is likely to degenerate into some form of bureaucratically managed farming. It may be noted that the record in terms even of production, in some other countries where such superimposition has taken place, has not been very impressive.

A course of participatory transition to collective agriculture will be strengthened if co-operative production in its various stages is managed well. The case studies indicate that the peasantry do not necessarily handle the complex questions in collective production and distribution well enough to sustain their own motivation in collective undertakings even if they are initially motivated. Blind belief in people's collective capability in handling their collective problems would appear in this light to be rather romantic for certain collective tasks for certain people at certain stages of their development. In general, the handling of complex collective functions should require some previous experience, or some other kind of learning process (e.g., training, exposure to how more experienced groups handle such tasks, etc.). An important task of the leadership is to arrange for this learning process as needed, and this by itself may be a constraint to the pace at which a course of participatory transition to collective agriculture may proceed.

A corresponding learning process is obviously crucial for the "cadres" who act as the vital link between the central leadership and the peasantry and who may, by their initiatives, either promote or destroy participation.

Much of the above implies that there is an evolutionary stream in participatory transition to agrarian collectivism irrespective of whether big thrusts from time to time are required or not—a sociological process of progressively

practising and learning, i.e., progressive *praxis*. This evolution does not necessarily start with any particular big thrust—in North Viet Nam the "sprouts of socialism" emerged long before the comprehensive land reform, and that was a positive development. For Ethiopia and Tanzania these "sprouts" may need to be stimulated and nursed before a big thrust is given.

As a general policy lesson, other countries facing compulsions to move towards collective agriculture would have a better chance of doing so the participatory way the earlier such "sprouts" take root, even before a macro thrust in transforming the agrarian structure is initiated.

Friends of the rural poor in the international system might wish to assist in a participatory transition to collective agriculture in countries seeking a course of egalitarian development through collectivist agrarian transformation. Participation, implying self-reliance, can be destroyed by over-assistance. But many forms of limited international assistance could be of help e.g., sponsoring and disseminating studies of experiences of countries more advanced in the transition to collective agriculture, disseminating advanced models of collective management in agriculture (e.g., work allocation and work point system) ; sponsoring of inter-country exchanges of leaders and cadres involved in steering agrarian transformation and other forms of "technical co-operation among developing counties" at different levels in this transition ; and supporting pilot experiments in co-operative production and cadre training programmes—if such assistance would be welcome.

The analysis in this paper has been concerned with the interaction of micro perceptions of the peasantry with macro perceptions of the national leadership. The question of peasant participation in macro policy making itself remains. This is a question not merely of a formal arrangement for peasant representation in higher-level decision making but also of the creation and effective functioning of autonomous forums in which the peasantry can deliberate on higher-level issues and through which they can exercise a countervailing power against the possible imposition of macro policies not in line with their own aspirations. Of the three countries studied, in none is there evidence of real involvement and assertion of the peasantry in the "affairs of the state". The "consciousness gap" in its fundamental sense therefore perpetuates, and contains in it the seeds of imposition by those who "know better" on those who may be unable to share their perceptions.

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Adoption of HYV Rice in Bangladesh*

by

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The present study analyses the problem of adoption of high yielding varieties of rice during the rainfed *aman* season in Bangladesh. Drawing on information from a village survey, the analysis confirms some of the well-known results (for an incomplete diffusion process) regarding effects of farm size and tenurial status on the decision to adopt and the extent of adoption. In an attempt to probe further the causal relationships behind adoption the analysis was extended to consider characteristics of farm households. Two variables reflecting consumption requirements and family labour availability relative to land were found to contribute significantly to the explanation of variation in adoption and its extent across farm sizes.

I. INTRODUCTION

The literature on HYV technology is full of studies which purport to show or deny that the gains from the introduction of the new agricultural technology have been unequally distributed among the large and the small farmers, between the landowner and the landless, between the owner operator and the sharecropper, between the city and the countryside and between regions.[1] Such differential gains, if any, depend among others on who adopts soonest with most intensity.[2] Although an extensive amount of literature exists on adoption and diffusion of innovations in general, there are not many in-depth works on adoption of high yielding varieties (henceforth HYVs) of cereals by farmers.[3]

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*The analysis here draws mainly from parts of the author's D. Phil. dissertation [2] submitted to the University of Sussex in June 1980.

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[1]There are numerous such studies. For a recent review of the evidence, see [14]. Earlier prominent works include, among others, [8 ; 11 ; 19].

[2]For a discussion on the factors giving rise to differential gains, see [14].

[3]For a critical review of the literature, see [2, Chap. I pp. 7-22]. Also see the relevant reference at the end of the chapter.

In the few studies that have actually been undertaken, usually only the farm size and tenurial status of a farmer are considered as the main economic variables. In general, it has been found that farm size has a positive correlation with adoption.[4] Regarding the extent of adoption, i.e., the proportion of land under HYVs, the general finding is that it is either inversely related to farm size or that the rlelationship has a U-shape. Tenurial status, in contrast, was not found to have a discernible impact on decision to adopt or on the extent of adoption.[5]

The reason why farm size and tenurial status are among the main factors to be investigated is that, in general, large farms and landowners benefit disproportionately from extension, credit and modern inputs supply activities. These activities facilitate HYV adoption. Such supply factors, however, fail[6] to explain the inverse relationship between farm size and the extent of adoption and the absence of any systematic impact of tenurial status.

The present paper intends to study more deeply the factors affecting the diffusion of HYV, so as to be able to explain the observed phenomena. The basic hypothesis of the present study is that the factors like subsistence under a risky situation and labour availability, through its effect on profitability, determine, to a considerable extent, the response of the peasantry in Bangladesh to HYV technology at least during the early phase of its adoption.

The rest of this paper is divided into four sections. Section II discusses the role of various factors, including subsistence and labour availability, that may influence the adoption decision of the farmer. In Section III we explain data sources and methodology of analysis. Results are given in Section IV while conclusions are drawn in Section V.

II. THEORETICAL CONSIDERATIONS

Before we begin, we would like to clarify two concepts that have been used throughout this paper. The first is *adopter-ratio* by which is meant the proportion (or percentage) of farmers in a group cultivating HYV.[7] Extent of adoption means the proportion of paddy land under HYVs. Unless otherwise stated, this refers to the adopter farms only.

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[4]*ibid.*

[5]*ibid.*

[6]See references in f.n. 1.

[7]This, of course, is a new term. The reason why we use it in place of others like 'rate of adoption' is that the meaning of the latter is not always clear. For a discussion on the problem of terminology, see [2, pp. 35-37].

In a situation like the one obtaining in Bangladesh, one cannot clearly understand the behaviour of the peasants without any reference to the physical, social and economic environment in which they live.[8] Very briefly speaking, the average peasant household in Bangladesh tills only a small area often under adverse weather conditions. Technology in farming is very much traditional. Yields per acre are not only uncertain, but also quite low. On the other hand average family size varies from five upwards. The net result is that there is a very widespread poverty giving rise to limited availability of food, and malnutrition.

In a situation as described above what would be the response of an average peasant family ? Naturally survival in general and consumption of food in particular become a major concern. There are two types of models of peasant behaviour which may help in analysing the problem at hand. One is the Chayanovian model ; the other type comprises of what are called the safety first models. Both types of models may be used to predict that an adopter farmer with higher subsistence needs will devote a larger proportion of land to HYVs. We shall very briefly state the reasons why.

Chayanov begins with the premise that the motive force behind the economic activities of a peasant family is consumption need, which increases with family growth.[9] A Chayanovian peasant responds to the growing consumption need by, apart from sacrifice of leisure, acquiring more of the means of production, particularly land. The latter may be acquired in several ways, viz. purchase, renting and colonization of virgin land. In the Bangladesh situation, none of the options offers any substantial scope for such acquisition. In this situation a yield-raising technology allows the peaseant to effectively increase the size of holding without altering its actual physical size. If so, the implication is that in an adopter farm, the extent of adoption will increase with an increase in consumption demand.

In the safety-first models, one begins with the assumption that the peasant wants to ensure survival for self and the family, and accordingly wants to avoid the risk of falling below a certain critical (subsistence) income or return. There are several variants of this basis theme.[10] In each case, it can be shown that as the minimum necessary income increases, the adopter peasant shall have to increase his extent of adoption since otherwise the subsistence constraint cannot be met.

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[8]Several authors have, from time to time, drawn attention to the situational context in which an action takes place. See, for example, [9].

[9]A. V. Chayanov put forward his ideas almost fifty years back in the context of the Russian peasantry at the turn of the century. An english translation of some of his works is contained in [5].

[10]For a discussion of the three basic variants and their comparison, see [2, pp. 50-58].

We have not so far indicated how consumption needs affect the decision to adopt as such. Such effects, and also those on the extent of adoption itself, will vary according to the measurement of consumption needs. To these issues we now turn.

Consumption Needs, Subsistence and Adoption

Consumption needs in a family is the total requirement for subsistence. This may be called *absolute* consumption needs. On the other hand, one may conceptualise relative consumption needs (which we call subsistence pressure) defined as absolute consumption needs relative to productive capacity in the family. These two variables will differ in their influence on the decision to adopt.

When the farmer faces the problem of adoption or rejection of the HYV's, a large absolute consumption requirement will tempt him to adopt. On the other hand, however, the outcome of such adoption may be uncertain because either he may not have cultivated HYVs before, or may have done so only a few times so that all the intricacies of the new paddies are not yet known to him. In such a situation relative consumption needs or subsistence pressure may also assume importance. If the peasant's productive capacity is not commensurate with the absolute requirement for consumption, this means that if anything goes amiss he may not have the ability to absorb the shock. We may then hypothesize that an increase in subsistence pressure will lead to lower adopter-ratio.

Once the peasant has decided to adopt, he may be said to have crossed a threshold. He has adopted HYVs despite some uncertainties. Now he will have to make that decision pay. As we have said before, according to both the Chayanov model and those based on the safety-first criteria, this will imply that the extent of adoption would have to rise with the increase in the minimum acceptable income. Thus the extent of adoption should vary directly with both the size of the consuming unit and the subsistence pressure. Regarding the effect of the former, however, there is a counterveiling force. As the consuming unit grows in size, there is very likely to be a diminution in the surplus available for financing purchases of cash inputs (in the absence of supply of credit, of course) necessary for HYV cultivation. Such a shortage of cash, if it occurs, is likely to restrict the farmers from extending the proportion of area under HYVs. The net effect of the size of the consuming unit will then depend upon the strengths of the individual influences of the urge for survival and cash squeeze.

Effect of Farm Size[11]

As has been pointed out earlier, most of the studies on 'green revolution' tried to find out the association between farm size and the adoption of HYVs. Here however, one should be careful to point out the forces of both demand and supply at work. The demand for HYV cultivation, as argued above, would be strong in groups with larger size of the consuming unit and lower subsistence pressure. Usually a large farm size goes with a large family size. On the other hand, a higher farm-size may go with a lower subsistence pressure because the size of the cultivable land, the principal constraining productive asset in a farm family is likely to rise faster than the size of the consuming unit.[12] The situation on the supply side is also favourable to the large farmers. In general, such farms, because of their higher incomes, economic power, social prestige and links with political authorities both at the national and local levels,[13] have more assured supply of different modern inputs and credit necessary for fruitfully utilising the potentials of the new HYV technology. The only factor of production a large farmer is likely to be less endowed with compared to a small farmer is labour, particularly family labour.

Now on the whole it seems that the large farmer is in a much more favourable situation to adopt HYVs. Regarding the extent of adoption, the result depends on whether one is investigating the influence of landholding when all other things are held constant or not. A positive relationship between extent of adoption and farm size is expected when the conditions of constancy of other factors hold. If it does not, then obviously the influence of other factors will be reflected in the observed pattern. Particularly, if subsistence pressure has a strong negative correlation with landholding, much of the pattern may actually be due to the influence of the former. If this negative influence in the demand side is sufficiently strong to outweigh the positive influence of landholding in the supply side, one will find a negative association between farm size and the extent of adoption.

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[11]The question of effect of farm size needs to be discussed keeping in mind the divisibility of the technology. In case of divisible technologies like HYV cultivation, adoption and the intensity of use may be separately discussed. For more details, see [2].

[12]As discussed in the next section subsistence pressure is measured by C/A where C denotes absolute size of the consuming unit (taking into account the age-sex composition) in the family and A is arable land in acres. Our data show negative correlation between C/A and farm size.

[13]For more details in the Bangladesh context, see Chapter II in [2].

Effect of Tenancy

Until recently, economists have not paid much attention to the theoretical investigation of the effect of share tenancy on adoption of new technology.[14] In general, these studies have tried to analyse whether or not the landlord would encourage the peasant to or prevent him from adopting the new technology.[15] Whether the tenant would demand the new technology or not does not seem to have been investigated. Neither has attention been paid to the subsistence constraint under which the tenant peasant operates.

Using the Chayanovian and the safety models we may understand the implications of the tenurial status for response of the peasant to the new technology. If we consider two peasant households, one owner and one tenant with the same amount of cultivable land and the same number of consuming units, the subsistence pressure in the latter household will be greater because it has to surrender a part of the output of land to the landlord. The subsistence models predict that in such a situation the extent of adoption in the tenant farm will be higher than that in the owner farm. What is more, the higher the proportion of landholding rented from others the higher will be the extent of adoption.[16]

As far as the adoption or rejection of the technology is concerned, the effect of subsistence constraint will be to make the tenant hesitant compared to the owner, because, as argued earlier, a higher subsistence pressure leads to lower probability of adoption. On the other hand, however, as the literature on share-tenancy indicates, tenants may be able to diversify the risks of crop failure and damage as part of the loss is passed on to the landlord. This induces the peasant to adopt the new technology. Thus, the net effect of tenancy on adoption or rejection is difficult to predict. Perhaps they largely cancel out each other which may be a reason why tenancy is found to be no bar against the spread of HYVs.[17]

Labour Availability, Profitability and Adoption

The literature of HYV cultivation shows that HYVs need more labour per acre than local varieties (LV) and that most of the extra need arises in

[14]Some of the noteworthy exceptions are [3 ; 10 ; 15 ; 16]

[15]Scandizzo [16] is an exception, but his results are not easy to comprehend and have been criticised as mysterious by de Janvry [12, pp. 135-139].

[16]It may be of interest to note that a sufficient, but not necessary, condition for this to occur is that the extent of adoption on rented land be higher than that on owned land.

[17]Admittedly, our reasoning here is somewhat crude and it neglects the various factors like landlords' pressures, indebtedness of the tenant, etc. There is also a simulataneity problem in the sense that although share cropping helps to diversify risk, the tenurial arrangement itself may come about as a means of diversifying risk.

stages like fertilization, weeding and irrigation which are of minor importance in LV cultivation.[18] Such a concentration leads to additional labour use peaks during the traditional 'slack' period.[19] The availability of family labour may in such a situation affect the peasant's decision to adopt and if he decides to do so his extent of adoption will be affected by that too. If the opportunity cost of family labour is high as may be the case with large farmers (here disutility of work is also being considered) then the response to innovation may be quite lukewarm as the alternative of hiring in more labour reduces profitability of the innovation. In small farms, however, such opportunity cost may be quite low either because opportunities for work outside one's own farm may be very much limited (as is true during a 'slack' period) and also because disutility of work may be low. In such a situation, whether small or large, if the size of the farm is held constant, one would expect a positive relationship between the extent of adoption and family labour availability.[20]

The labour availability that we are speaking about is relative to land, the other main productive asset. One may then alternatively interprete relative labour scarcity as relative land abundance. This interpretation is more appropriate in the case of adoption/rejection of the innovation. Relative land abundance enables a peasant to cushion a part or whole of the adverse effects, if any, due to adoption. Thus, the likelihood of adoption is expected to increase with relative land abundance.

Education and Adoption

One particular factor which sometimes has drawn attention of economists as a contributory cause towards agricultural development is education.[21] Empirical studies show that education has significantly positive, though numerically small, influence on the innovation behaviour of the peasants. We accept the hypothesis and expect that both adopter-ratio and the extent of adoption will be positively correlated with education and literacy.

The discussion on the effects of various factors above may be summarised into several hypotheses. These are as follows. ('+'means direct relationship,

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[18]See [1].

[19]Of course, the assumption implicit here is that the distribution of labour requirements of the two varieties overlap considerably. It is not clearly known how far such overlapping occurs, but a report by Clay suggests that this may not be an implausible assumption. See [6, pp. 49 and diagram 1].

[20]However, the issue may not be so simple. There may be more than one force at work here. Still, under certain plausible assumptions, the hypothesis is expected to hold. For details of the argument, see [2, p. 67].

[21]See [4 ; 13 ; 17].

while '—' means inverse relationship, '?' means that the relationship is theoretically unpredictable, while '×' signifies that the influence of a particular factor has not been investigated.)

Factor	Influence on	
	Adopter-ratio	Extent of Adoption
Farm Size	+	+
Tenancy	?	+
Proportion of Land Leased in	×	+
Size of Consuming Unit	+	?
Labour Scarcity (Land Abundance)	+	—
Subsistence Pressure	—	+
Education	+	+

These hypotheses usually do not consider the influence of the factors in isolation of others. Accordingly, some modifications are needed when such pure effects are investigated. These will be indicated in appropriate places in Section IV.

III. METHODOLOGY AND DATA

Definition of Variables

Farm size (F) : Farm size has been defined as operational holding in acres and includes both arable and non-cultivable land.[22]

Absolute Consumption Need (C) : The absolute consumption need in a peasant family is of course the total requirement for subsistence. If we consider a village, it may be presumed to be a substantially small entity within which requirement per person is not likely to vary much. The absolute pressure may be measured by the number of consuming units (standardised for age and sex) in the family.[23]

[22]Another definition of farm size may be area of land owned. In general, the difference in measurement does not appreciably affect the results and does not cause any change of directions of relationships. See [2, chapter VI] and also the regression results in Section IV.

[23]The standardisation is done in terms of "male adult equivalents", adult female and children being converted into .9 and .5 male adult equivalents respectively. Adults are defined as persons above ten years of age.

No. of Workers (W) : Number of workers are taken to be the number of adult males available for work in the field and excludes full time students.[24]

Subsistence Pressure (S) : Subsistence pressure or relative consumption need may be measured in two ways. One is Chayanov's Consumer-Worker ratio (C/W), the other is the consumer-arable-land ratio (C/A) where A denotes arable land in acres. In this study, we opt for the latter because in the Bangladesh context this seems to be a better measure, as in general land, not labour, is more of a constraining factor in agricultural production.

Labour Scarcity (A/W) : Relative labour scarcity is measured by the ratio of arable land to number of workers in the family.

Education (E) : The data available to us allow only construction of an educational score for each family. For each member of a family, there is information on the minimum level of education (primary, secondary etc.) he/she has. For each level we have given an arbitrary but not wholly implausible score. The total of these scores is the educational score for the family.[25] If the total score is zero it means that all the members are illiterate.

Statistical Techniques for Analysis

We have used both parametric and non-parametric techniques for statistical analysis of data. The latter includes chi-square and F tests. Among the parametric methods we have used linear probability regressions and discriminant analysis.

The linear probability model (LPM) is a special case of ordinary least square regression where the dependent variable is binary. As the peasant either rejects or adopts HYV cultivation, his response may, without loss of gnerality, be expressed as a dummy variable assuming the value zero (for rejection) and unity (for adoption). One can in such a situation use LPM.[26]

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[24]The exclusion of woman from the worker category may be questioned. But as discussed in [2] from which this report is drawn, this is unlikely to give rise to any pronounced bias in any of the results that follow in the next section.

[25]For details, see [2, pp. 179-180].

[26]The LPM suffers from several drawbacks, both theoretical and empirical. The main empirical problem is heteroscedasticity for which reason one cannot use 't' tests for assessing significance of the regression parameters. However, a relative ranking of their importance can still be done on the basis of the absolute magnitude of the 't' values ; furthermore, the estimates of the parameters are unbiased. For details of the problems and advantages of using LPM see [2, pp. 133-143].

In addition to the LPM, we also use discriminant analysis which is particularly suitable for differentiating between two or more groups. In the present case a subset of the variables measuring different characteristics of the adopters and non-adopters are used to construct a *discriminant function* such that the variance between the two samples (of adopters and non-adopters) relative to the pooled variance within sample is maximised. Thus adopters are distinguished as far as possible from the non-adopters.

The LPM and the discriminant analysis are used to analyse the adoption/ rejection problem. To analyse the variation in the extent of adoption, we use ordinary least square regression and logit regression. There is a problem with OLS estimation, however. Extent of adoption is a ratio and its value is limited within (0,1) range. But the expectation of the dependent variable in an OLS regression may fall beyond this range. To tackle the problem we have alternatively used logit regression which has the general form.

$$\ln \frac{P_i}{1-P_i} = BX_i + U_i$$

for the i th adopter,

where P_i=extent of adoption

B=a vector of coefficients

X_i=a vector of explanatory variables

U_i=error term.

It is assumed that the asymptotic variance of the error term does not vary much. One may then use OLS for estimating the vector B.[27]

Data

Data for the present empirical analyses are drawn from a survey on rainfed HYV cultivation conducted by BIDS in 1973/74 *aman* season. We

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[27]One interesting problem we had to face in analysing the data was to disentangle the effects of subsistence pressure and labour scarcity. To be more specific the former may be expressed as follows :

$$S=C/A=(C/W)/(A/W)$$

Taking logarithms on both side

$$\ln S = \ln (C/W) - \ln (A/W)$$

If C/W remains largely constant (which is what we found from our data), the logarithms of S and A/W will be highly correlated. The high multicollinearity between S and (A/W) then precludes their simultaneous inclusion in a loglinear regression equation. On the other hand, S and A/W should only be rather imperfectly correlated in a linear regression between them, so that the two may be used together in a linear or logit regression equation.

chose information from two villages, *Kogaria* in Rangpur district and *Mohammadpur* in Noakhali district, for detailed analysis.[28]

IV. RESULTS

The total number of households in Kogaria and Mohammadpur were 174 and 167 respectively at the time of survey. Of these respectively 133 and 142 were farm households. The rest were non-farm families i.e., they were not involved in any direct operation of a farm. Some of the characteristics of the households are given in Appendix Table A.1.

The size distribution of farms in the two villages are shown in Appendix Tables A. 2a and A.2b. These highlight the fact that the average farm size in Mohammadpur is smaller compared to that in Kogaria. Also, there are no large farms in Mohammadpur, while a few such farms do exist in Kogaria.[29]

TABLE I

ADOPTION OF HYVs BY OPERATIONAL HOLDINGS

Size of Farm (acres) (1)	No. of Farms (2)	No. of Adopters (3)	Adopter-ratio (4) $=(3)\div(2)\times 100$
Kogaria			
Less Than 1	16	2	12.50
1– ∠ 2	43	17	39·53
2– ∠ 3	28	18	64.28
3– ∠ 4	19	12	63.16
4– ∠ 6	16	12	75.00
6+	11	7	63.64
All Farms	133	68	51.12
Mohammadpur			
Less Than 1	77	29	37.66
1– ∠ 2	37	33	89.19
2– ∠ 3	13	10	76.92
3– ∠ 4	11	9	81.82
4+	4	3	75.00
All Farms	142	84	59.15

[28]See [2, pp. 143-147] for details about background information on the two villages.

[29]Of course 'large' is only a relative term here. These large farms are much smaller in comparison to those elsewhere in many places of, say, neighbouring India.

Factors Affecting Adoption

Farm Size

The relationship between farm size and adopter-ratio in the two villages is shown in Table I. This table confirms the usual positive relationship between operational holding and the adopter ratio.[30]

Tenurial Status

To see the effects of tenurial status on adoption we first lumped all types of tenants, whether share tenant or fixed rent tenant, pure or owner-cum-tenatnts. This has been done primarily to ensure enough cell frequencies, but also because no elaborate subgrouping regarding types of tenancies resulted in any substantial alteration of the pattern. Owner-cum-tenants and pure tenants have been grouped together to highlight the difference between owners and tenants although there may be three more forms of comparison here, viz. between owner-cum-tenants and owners, between owners and pure tenants and between onwer-cum-tenants and pure tenants.[31] Table III shows the effects on adopter-ratio when farms are classified either as owners or tenants. It is seen that adopter-ratio is higher among the tenants although it is statistically significant only in one of the villages.

TABLE II

ADOPTION OF HYVs BY TENURIAL STATUS

Tenurial Status	No. of Farms	No. of Adopters	Adopter-ratio
Kogaria			
Owner	57	26	45.61
Tenant (all types)	76	42	55.26
Mohammadpur			
Owner	103	53	53.40
Tenant (all types)	39	29	74.36

Note : Value of chi-square is insignificant for Kogaria and significant at 1 per cent level for Mohammadpur.

Absolute Consumption Needs and Subsistence Pressure

Tables III and IV show the variations in adopter-ratio when farms are classified by C and C/A. Adopter-ratio is found to increase with an increase

[30]Chi-square values showing degrees of association are significant at 1 per cent level.

[31]For details of these comparisons, see [2, p. 170].

n the standardised family size. On the other hand, increasing subsistence presure influences the adoption decision negatively.

Arable Land per Worker

Table V shows the effect of A/W on adopter-ratio. The pattern and its level of statistical significance confirm our hypothesis that a higher A/W leads to higher adopter-ratio.

TABLE III

ADOPTION OF HYVs BY SIZE OF THE CONSUMING UNIT

Size of the Consuming Unit(C)	Adopter-ratio in	
	Kogaria	Mohammadpur
Upto 2	7.14	40.00
2–4	51.78	50.00
4–6	69.44	62.50
6+	52.00	75.60
All Units	51.12	59.15
Chi-square	15.69***	9.82***
	(3)	(3)

Note : Figures within parentheses refer to d. f. ; ***—sig. at 1%,**—sig. at %,* —sig. at 10%.

TABLE IV

ADOPTION OF HYVs BY SUBSISTENCE PRESSURE

Subsistence Pressure (C/A)	Adopter-ratio in	
	Kogaria	Mohammadpur
Upto 1	61.54	—
1–2	65.31	81.25
2–3	44.74	75.00
3+	50.00	54.38
All Farms	51.12	59.55
Chi-square	9.31**	5.55*
	(3)	(2)

Note : See Table III.

TABLE V

ADOPTION OF HYVs BY ARABLE LAND PER WORKER

Arable Land (C/A) (acres)	Adopter-ratio in	
	Kogaria	Mohammadpur
Up to 0.25	—	37.70
0.25—0.50	23.81	59.00
0.50—1.00	50.00	77.10
1.00—2.00	63.58	93.33
2.00+	60.00	
Chi-square	9.28** (3)	22.00*** (3)

Note : See Table III.

TABLE VI

ADOPTION OF HYVs BY LITERACY

Literacy Status	Adopter-ratio in	
	Kogaria	Mohammadpur
Illiterate	42.46	35.60
Literate	61.70	70.10
Chi-square	4.86** (1)	13.79** (1)

Note : See Table III.

Literacy

The variations in adopter-ratio by literacy status are shown in Table VI. The significance of the chi-square values indicate that literacy has an important role to play in the adoption of HYVs.

So far the hypotheses regarding the effects of various factors have not been refuted. However, in view of the bivariate nature of the relationships explored, these effects are not pure and include those of others. Particularly, as we have argued in Section II, the effect of subsistence pressure may be a prime factor in determining the observed patterns in adopter-ratio whenever farms are classified according to certain criterion. To investigate the pure effects we have used the linear probability model and the discriminant analysis.

Result of Application of the Linear Probability Model

Here the regressand is a binary variable, say, Y which takes the value zero when the peasant rejects the innovation, and unity when he accepts it.

The list of regressors include L_1, L_2, C, S, T, A/W and E. L_1 refers to land owned whereas L_2 is operational holding in acres. C, S, A/W and E are as defined before. The last one is now a dummy variable being zero for illiterates and unity in other cases. The regression coefficients of all the variables except for that of S are expected to be positive. In case of S it should be negative.

Table VII shows the regression parameters along with the 'pseudo' t-statistics. The results may be summarised as follows :

(i) Except for the land holding variables and for C in one case (eqn.2) all the signs are as expected. In the case of landholding variables three out of five regression parameters are negative. Of these, two refer to land owned while the third refers to land operated. As the latter is more relevant for farm management decisions, inclusion of L_1 in place of L_2 may be less appropriate. No firm conclusion may, however, be made here.

TABLE VII

RESULTS OF LINEAR PROBABILITY REGRESSION ON HYV PADDY ADOPTION

Explanatory Variables	Kogaria		Mohammadpur		
	Eqn. 1	Eqn.2	Eqn.3	Eqn. 4	Eqn.5
L_1	-0.02 (0.58)		-0.05 (0.86)		
L_2		0.05 (1.01)		-0.03 (0.42)	0.04 (0.81)
S	-0.04 (2.09)	-0.03 (1.51)	-0.01 (3.22)	-0.01 (2.98)	-0.01 (2.95)
A/W	0.06 (1.13)	-0.01 (0.22)	0.20 (1.81)	0.18 (1.46)	
C	0.03 (1.01)	-0.004 (1.15)	0.05 (2.02)	0.04 (2.07)	0.03 (1.50)
T	0.03 (0.29)	0.07 (0.84)	0.07 (0.75)	0.10 (1.24)	0.10 (1.24)
E	0.12 (1.21)	0.11 (1.61)	0.17 (1.89)	0.16 (1.81)	0.18 (1.99)
Constant	0.39	0.41	0.31	0.31	0.34
R^2	0.117	0.122	0.265	0.262	0.250

Note : The figures in parentheses are 'pseudo' t-values.

(ii) Judging by the value of 'pseudo' t-statistic, operational holding seems to be a better explanatory variable than land owned. This again indicates that the use of the latter in an equation may result in specification bias leading to signs of coefficients contrary to expectation.

(iii) Judging by the 'pseudo' t-values, the influence of literacy particularly in Mohammadpur seems to be quite remarkable and stronger than those of even landholding variables.

(iv) The R^2 values are not high. But this was expected as explained earlier in Section III. Similar low values have been reported by others analysing adoption of new crops like HYV maize or wheat.[32]

A Discriminant Analysis of Adoption

The variables that have been used for discriminant analysis of adoption are the same as in the case of linear probability regressions. The resulting discriminant coefficients (standardised) along with other parameters and statistics of interest are shown in Table VIII. An examination of the table leads to the following conclusions :

(i) Apart from landholding variables, subsistence pressure is the only variable with any discriminatory power between the adopters and non-adopters in Kogaria. In Mohammadpur though, there are other variables with some discriminatory powers ; but barring L_1 and L_2, none of these is as powerful as subsistence pressure. In contrast, the discriminatory power of A/W is rather poor.

(ii) The signs of coefficients for all the variables except for L_1 are consistent with our hypotheses about their effect on the decision to adopt/reject HYVs.

(iii) Although the values of the minimum D^2 and those of the discriminant functions at group means indicate lower discriminatory power in Kogaria, the significance of the chi-square values indicate a successful separation of the groups (of adopters and non-adopters) in both the villages.

Factors Affecting the Extent of Adoption

We now come to the second part of the problem involving the investigation of the factors behind the observed patterns of extent of adoption.

The total land under rice in Kogaria and Mohammadpur during the time of the survey were 291.31 and 141.46 acres respectively. Of these only 30.4 and 21.4 acres were under HYVs. Thus the extent of adoption in the

[32]See [7], for example.

two villages were only of the order of about 10 and 15 per cent. While trying to find the significance of the variation in average extent of adoption among various groups, we use the average of extents in each group. The

TABLE VIII

DISCRIMINANT ANALYSIS OF ADOPTION OF HYV PADDY

Discriminating Variables	Standardised Discriminant Coefficients	
	Kogaria	Mohammadpur
L_1	0.81	0.77
L_2	-1.27	-0.61
C		-0.52
S	0.40	0.61
A/W		-0.33
E		-0.37
Minimum D^2 (Mahalanobis)	0.60	1.49
Value of Function at Group Means		
Adopters	-0.38	-0.50
Non-adopters	0.40	0.73
Chi-square	18.44 (Sig. at ; 04%)	42.83 (Sig. at 0%)

Note : Tenurial status failed to enter any of the discriminant functions and hence is not shown as a discriminating variable.

average for all the adopters are similarly calculated. This then is different from the extents of adoption mentioned above. In fact these are much higher than the weighted averages of 10% and 15%. The respective percentages are now 21 and 27.

Operational Holding

The hypothesis of a positive correlation between operational holding and the extent of adoption are not borne out by data as shown in Table IX.[33]

[33]Because the samples of adopter farms are much smaller than those for all farmers, we have divided the farmers into three broad categories of small, medium and large. In Kogaria, the cut-off points are 3 acres and 6 acres while in Mohammadpur these are 2 acres and 4 acres. These groupings, though arbitrary, have taken into account the fact that operational holdings are larger and cropping intensity is lower in Kogaria than in Mohammadpur.

TABLE IX

EXTENT OF ADOPTION BY SIZE OF FARM

Size of Farm	Kogaria	Mohammadpur
Small	26.50	30.46
Medium	16.90	16.73
Large	8.00	18.99
F-statistic	5.91***	3.34***
	(2.65)	(2.81)

Note : The extents are prcentages of the total area cultivated with HYVs.***,** and * dentote levels of significance of the estimated F-statistic at 1%, 5% and 10% respectively. Figures in parentheses are degrees of freedom for the numerator and denominator of the respective F-statistic.

The two villages reveal broadly the same pattern in that small farmers adopt to a larger extent than do the larger ones. The pattern is monotonic in Kogaria but not so in Mohammadpur, although these are significant in both the places. These results are not consistent with our hypothesis, but are in conformity with those found elsewhere. The question that arises is why should it be so.

As stated earlier, one of our main hypotheses is that subsistence pressure (C/A) determines to a considerable extent the response of the peasantry to new yield-raising technology. If C/A declines with an increase in operational holding and the extent of adoption varies directly with C/A, then it may counterbalance the pure effect of farm size, so that the net effect of farm size may turn out to be indeterminate.

Table X shows the average subsistence pressure in farms of various sizes among the adopter farms in the two villages. The inverse relationship between subsistence pressure and the size of operational holding is clearly established. The C/A ratio monotonically declines with farm size and is highly significant in both cases. We then accept for the moment that the inverse relationship between farm size and the extent of adoption may be attributed to that between farm size and subsistence pressure. We still have to prove that the extent of adoption does really vary directly with subsistence pressure. We shall come to that shortly.

TABLE X

VARIATION IN SUBSISTENCE PRESSURE BY FARM SIZE AMONG ADOPTERS

Size of Farm	Average Subsistence Pressure in	
	Kogaria	Mohammadpur
Small	2.81	8.12
Medium	1.59	2.81
Large	0.77	2.31
All Farms	2.17	6.71
F-statistic	9.68*** (2.65)	5.39**** (2.81)

Note : See Table IX.

Tenurial Status

It is seen fom Table XI that in both places pure tenants have the highest extent of adoption followed by owners and owner-cum-tenants in that order. But the inter-group differences are not significant.

To explain these patterns we again looked into variation in subsistence pressure by tenurial status (Table XII). It is seen that subsistence pressure does not vary significantly by tenurial status in any of the villages.

TABLE XI

EXTENT OF ADOPTION BY TENURIAL STATUS

Tenurial Status	Kogaria	Mohammadpur
Owner	21.80 (26)	28.77 (55)
Owner-cum Tenant	20.00 (36)	22.18 (27)
Pure Tenant	25.50 (6)	41.27 (2)
All farms	21.20 (68)	26.95 (84)
F-Statistic	0.31 (2.65)	1.31 (2.81)

Note : The figures in parentheses under those for extents of adoption in the first four rows refer to the number of farms in the respective category. Those in the last row refer to the relevant degrees of freedom.

TABLE XII

VARIATION IN SUBSISTENCE PRESSURE BY TENURIAL STATUS

Tenurial Status	Average Subsistence Pressure in	
	Kogaria	Mohammadpur
Owner	2.42	7.57
Owner-cum-Tenant	1.92	4.97
Pure Tenant	2.57	6.73
All Farms	2.17	6.71
F-Statistic	1.01	1.28
	(2.65)	(2.81)

Absolute Consumption Need

Table XIII shows the variations in extents of adoption when adopter farms are classified according to the size of the consuming unit. In Kogaria there is no definite pattern, while in Mohammadpur the extent of adoption seems to be lower in larger consuming units, although the pattern is not monotonic. As there are opposing forces at work here, such patterns (or rather the lack of it) are not surprising.

TABLE XIII

EXTENT OF ADOPTION BY SIZE OF THE CONSUMING UNIT

Size of the Unit	Kogaria	Mohammadpur
Less Than 2	20.00	55.18
2−<4	26.15	18.99
4−<6	18.59	23.78
6+	13.39	25.01
All Farms	21.20	26.95
F-statistic	1.78	8.69***
	(3.64)	(3.80)

Subsistence Pressure

Earlier we have hypothesised that the extent of adoption should vary directly with C/A. Although the patterns as seen from Table XIV do not refute the hypothesis, these are not statistically significant, which is probably due to the influence of other factors e.g., farm size. If farm size has an in-

dependent positive influence on the extent of adoption while subsistence pressure is inversely related to it, the effects of the two may largely cancel each other out, making the intergroup variation in the present case insignificant. Of course there is some sort of circularity of argument involved here. This is so because we are actually unable to conduct a two-way analysis of variance because of smallness of the sample size.[34]

Relative Labour Scarcity (A/W)

The hypothesis of a negative relationship between the above two variables are tested in Table XV. On the basis of the test, it may be said that relative labour scarcity limits the extent of adoption of HYVs.

TABLE XIV

EXTENT OF ADOPTION BY SUBSISTENCE PRESSURE

C/A	Kogaria	Mohammadpur
Upto 1	9.15	14.49
1–2	19.60	14.56
2–3	23.70	27.04
4+	30.00	29.53
All Units	21.20	26.95
F-statistic	2.39	1.78
	(3,64)	(3,80)

TABLE XV

EXTENT OF ADOPTION BY RELATIVE LABOUR SCARCITY (AW)

A/W	Kogaria	Mohammadpur
Less Than 0.5	51.42	37.62
0.5–1.0	18.13	33.41
1.0–2.0	23.17	17.85
2.0+	12.73	18.63
All Farms	21.20	26.95
F-statistic	10.95***	5.35***
	(3.64)	(3.80)

[34]Our regression analysis below shows, C/A has a much stronger independent effect on the extent of adoption.

Literacy

Table XVI shows that illiterate families have higher extent of adoption in both the villages. This is contrary to our expectation. However, as most of the illiterate families are small, and as small farms allocate a higher proportion of paddy land to HYVs, such results are not wholly implausible. Controlling for farm size and subsistence pressure, one may obtain a direct relationship between adoption and literacy. As we shall see later, significant coefficients of literacy in multiple regression equations are usually positive.

TABLE XVI

EXTENT OF ADOPTION BY LITERACY

Status	Kogaria	Mohammadpur
Illiterate	23.00	46.00
Literate	19.60	22.45
All Farms	21.20	26.95
F-statistic	0.74	18.89
	(1.66)	(1.82)

Regression Analysis of the Extent of Adoption

Our multivariate anaysis is conducted in terms of linear and logit regression equations. The dependent variables, representing the extent of adoption are denoted as Y_1 and Y_2 $(= \ln Y_1/(1-Y_1)$, for the linear and the logit regressions respectively. The explanatory variables now include all those used for the linear probability model (B now being defined as the proportion of cultivable land leased in by the farm).

It is expected that except for those of C and A/W, all the coefficients will be positive. In case of C it cannot be predicted and in case of A/W it should be negative.

The equations that are presented here have been selected primarily on the basis of their explanatory power and on the basis of absence of heteroscedasticity of the error terms.

Kogaria

The equations for all adopters and also for owner and tenant adopters are shown in Tables XVII and XVIII. An examination of the equations leads to the following conclusions :

(i) In general the consumption variables (S and C) are more influential than others in determining the peasants' average allocation between local varieties and HYVs. Particularly if one considers the linear

equations, S has significant coefficients in all the eight equations while C has in six and A/W in none. Such results clearly indicate that the consumption variables are more important than A/W which may have at best a subordinate or secondary role.

(ii) S and A/W have respectively positive and negative co-efficient, as expected, in all the equations. C has negative coefficients indicating that cash constrainsts may hinder expansion of HYVs.

(iii) Contrary to expectations, the coefficients of land variables are not. in general, significant and are negative in the logit equations. In the linear equations, however, these are all positive.

(iv) The effect of tenurial status is not clear. However, when only tenants are considered, the proportion of land leased in is seen to have a positive coefficient in all the equations it enters.

(v) No firm generalisation may be made about the effects of literacy. In case of owners, however, these coefficients are weekly significant and positive.

TABLE XVII

LINEAR REGRESSION EQUATIONS (KOGARIA)

Explanatory Variables	All Adopters (N=68)			Owners (N=26)		Tenants (N=42)		
	Eqn.1	Eqn.2	Eqn.3	Eqn.4	Eqn.5	Eqn.6	Eqn.7	Eqn.8
L_1		0.01			0.02			
		(0.91)			(0.61)			
L_2	0.02		0.004	0.02				
	(1.19)		(0.38)	(0.70)				
S	0.07***	0.07***	0.07***	0.07***	0.07***	0.07***	0.05***	0.05*
	(5.65)	(5.63)	(5.63)	(5.20)	(5.16)	(3.05)	(2.05)	(1.82)
A/W	-0.02	-0.02		-0.02	-0.02			-0.02
	(1.15)	(0.88)		(0.68)	(0.61)			(0.96)
C	-0.04***	-0.03***	-0.03***	-0.02	-0.02	-0.03**	-0.03**	-0.03*
	(2.97)	(2.84)	(2.96)	(1.24)	(1.14)	(2.54)	(2.53)	(1.78)
T	-0.003	0.02	0.004					
	(0.09)	(0.40)	(0.12)					
E	-0.02	-0.01		0.12*	0.12*			-0.05
	(0.52)	(0.37)		(1.77)	(1.77)			(1.23)
B						0.09	0.09	0.09
						(1.23)	(1.11)	(1.09)
Constant	0.21	0.21	0.18	0.04	0.05	0.16	0.12	0.13
$\bar{R}^2$	0.434	0.428	0.471	0.625	0.623	0.292	0.296	0.305

TABLE XVIII

LOGIT REGRESSION EQUATIONS (KOGARIA)

Explanatory Variables	All Adopters (N=67)		Owners (N=25)	Tenants (N=42)		
	Eqn.9	Eqn.10	Eqn.11	Eqn.12	Eqn.13	Eqn.14
L_1	-0.001	-0.12*		-0.11	-0.002	
	(0.01)	(1.94)		(0.70)	(0.01)	
L_2			0.03			-0.03
			(0.17)			(0.18)
S	0.24	0.16**	-0.003	0.38**	0.31*	0.28
	(1.63)	(2.16)	(0.01)	(2.40)	(1.91)	(1.35
A/W	-0.17		-0.23)		-0.20	-0.18
	(1.55)		(1.01)		(1.61)	(1.32)
C	-0.14*	-0.06	-0.05	-0.19**	-0.21**	-0.19
	(1.82)	(1.03)	(0.35)	(2.18)	(2.44)	(1.62)
T	-0.009	-0.18				
	(0.03)	(0.80)				
E			0.85*			
			(2.06)			
B				0.51	0.76	0.75
				(0.77)	(1.13)	(1.58)
Constant	-1.08	-1.22	-1.56	-1.63	-1.37	-1.32
$\bar{R}^2$	0.233	0.243	0.186	0.376	0.401	0.402

Mohammadpur

Here only the logit equations are shown for all adopters and owners in Table XIX, as the linear equations were not found to be well-specified. In case of tenants, no suitable form was found.

It is apparent from the equations that the results are somewhat different from those in case of Kogaria in that landholding variables seem to have a significantly negaive influence on the extent of adoption. This may be attributed to factors like profitability. If one looks at the Appendix tables A.3 and A.4, it will be apparent that as the size of holding increases, extra labour costs due to HYV cultivation rises faster in Mohammadpur. Consequently extra profitability declines faster in that village. It may be that when only landholding is allowed to vary, keeping the other variables constant, the positive impact of increasing size is outweighed by the negative impact of declining profitability. One may then observe a negative coefficient of landholding.

TABLE XIX

LOGIT REGRESSION EQUATIONS (MOHAMMADPUR)

Explanatory Variables	All Adopters (N=80)		Owners (N=51)		
	Eqn.1	Eqn.2	Eqn.3	Eqn.4	Eqn.5
L_1	-0.20**				-0.22*
	(2.61)				(1.75)
L_2		-0.21**	-0.24**	-0.17	
		(2.46)	(2.68)	(1.29)	
S	0.04***	0.03**	0.04***	0.03***	0.03**
	(2.93)	(2.60)	(3 03)	(2 68)	(2.44)
A/W	-0.03	-0.04		-0.17	-0.12
	(0.17)	(0.22)		(0.72)	(0.53)
C			-0.10	-0.02	-0.001
			(0.28)	(0.39)	(0.03)
E	-0.08	-0.10		-0.36	-0.36
	(0.39)	(0.47)		(1.52)	(1.56)
Constant	-1.16	-1.08	-1.14	-0.77	-0.83
$\bar{R}^2$	0.277	0.270	0.488	0.500	0.514

As in Kogaria, we again observe the relative importance of subsistence pressure compared to labour scarcity.

V. CONCLUSION

Two central findings emerge from our preceding analysis. First, subsistence needs in a risky situation shape fairly strongly the behaviour of the peasantry in an environment like that in Bangladesh. The second finding concerns the apparent reversal of the roles of various factors once adoption has taken place. In the adopter farms almost all the factors which facilitated or inhibited adoption seems to influence the extent of adoption in diametrically opposite ways. Such results elearly indicate a threshold point in the peasants' response to HYV cultivation.

We have not tested whether or not a threshold actually exists. This implication needs to be investigated with better tools than ours. However, assuming that such a threshold exists, it is likely to be a combined function of variables e.g., subsistence pressure, arable land per worker, education and perhaps landholding. If the individual components behave as they have been

shown to do, the results in this study have important policy implications. Particularly, the behaviour of S and A/W indicate that land reform which may be distributive at the first stage at least, is likely to help in encouraging the extent of adoption. Of course, again on the basis of the above analysis, such a reform would adversely affect the decision to adopt, but this may be combatted with the help of good extension facilities. Provision of good extension facilities are likely to lessen subjective and objective risks of adoption and thus facilitate the cultivation of HYVs.

In the absence of any distributive land reform, any significant increase in the extent of adoption may come about only through HYV diffusion in larger farms. If our analysis above is any guide the diffusion would be constrained by labour scarcity in larger farms. The alternative of leasing in labour reduces profitability and thus discourage HYV cultivation. The only way out in this situation for them is to mechanise. Such measures, however, may have disastrous effects on the already serious employment situation in rural Bangladesh.

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Appendix

TABLE A.1

CHARCTERISTICS OF HOUSEHOLDS IN KOGARIA AND MOHAMMADPUR

Characteristics	Kogaria	Mohammadpur
1. No. of Families	174	167
2. No. of Farm Families	133 (76%)	142 (85%)
3. No. of Non-farm Families	41 (24%)	25 (15%)
4. No. of Landless Families	54 (31%)	31 (18%)
5. No. of Owner Cultivator Families	57 (43%)	103 (73%)
6. No. of Mixed-tenant Cultivator Families	58 (44%)	29 (20%)
7. No. of Pure Tenant Cultivator Families	18 (13%)	10 (7%)
8. Average Area of Land Owned in Farm Families (acres)	2.03	1.19
9. Average Area of Operational Holding in Farm Families (acres)	2.61	1.29
10. Average Area of Cultivable Operational Holding in Farm Families (acres)	2.35	1.03
11. Average No. of Persons per Farm Family	5.56	6.24
12. Percentage of Literate among Farm Families	45	68

Note : The percentages in rows (2)—(4) are with respect to the figures in row (1) while those in rows (5)—(7) are with respect to numbers in row (2).

Source : Unpublished BIDS survey on IR-20 cultivation.

TABLE A. 2a

SIZE DISTRIBUTION OF FARMS IN KOGARIA

Size of Operational Holding (acres)	No. of Farms	Total Land (acres)	Percentage of Farms	Percentage of Area
Less Than 1	16	9.60	12..03	2.95
1—∠ 2	43	60.63	32.33	18.67
2—∠ 3	28	41.11	21.05	12.66
3—∠ 4	19	64.41	14.29	19.83
4—∠ 5	15	62.85	11.28	19.35
5—∠ 6	1	5.16	0.75	1.59
6—∠ 7.5	8	51.68	6.01	15.91
7.5+	3	29.34	2.25	9.03
All Farms	133	324.78	100.00	100.00

Note : Percentages may not add up exactly to 100 because of rounding error.

Source : Unpublished BIDS survey on IR-20 cultivation.

TABLE A.2b

SIZE DISTRIBUTION OF FARMS IN MOHAMMADPUR

Size of Operational Holding (acres)	No. of Farms	Total Land (acres)	Percentage of Farms	Percentage of Area
Less Than 1	77	39.48	54.22	21.58
1–< 2	37	54.67	26.06	29.89
2–< 3	13	31.58	9.15	17.26
3–< 4	11	39.23	7.75	21.45
4+	4	17.96	2.82	9.82
All Farms	142	182.92	100.00	100.00

Note : Percentages may not add up to 100 due to rounding error.
Source : Unpublished BIDS survey on IR-20 cultivation.

TABLE A.3a

PROFITABILITY OF RICE VARIETIES BY SIZE OF FARM IN KOGARIA

Farm Size	Local Varieties (Tk.)	HYVs (Tk.)	$\frac{HYV}{Local} \times 100$
Small	512	712	139
Medium	548	735	134
Large	612	684	112
All Farms	554	718	130

Note : The number of farms used for estimating the returns in the above table is 66 as only those cultivating both local and high yielding paddies have been considered for the sake of comparability.

TABLE A.3b.

PROFITABILITY OF RICE VARIETIES BY SIZE OF FARM IN MOHAMMADPUR

Farm Size	Local Varieties (Tk.)	HYVs (Tk.)	Other Imp. Varieties (Tk.)	$\frac{HYV}{Local} \times 100$	$\frac{HYV}{Improved} \times 100$
Small	955	1,329	1,163	139	122
Medium	939	1,166	1,016	124	108
All Farms	947	1,223	1,090	129	112

Note : For comparability only 34 farms, equally distributed between the groups, who have cultivated all the three varieties have been used for these estimates.

TABLE A.4a

LABOUR COSTS IN RICE CULTIVATION PER ACRE IN KOGARIA

Size of Farm	Local (Tk.)	HYV (Tk.)	$\frac{\text{HYV}}{\text{Local}} \times 100$
Small	135	152	112
Medium	164	179	109
Large	267	354	132
All Farms	184	189	103

Note : See Table A. 3a.

TABLE A.4b

LABOUR COSTS PER ACRE IN RICE CULTIVATION IN MOHAMMADPUR

Size of Farm	Local (Tk.)	HYV (Tk.)	$\frac{\text{HYV}}{\text{Local}} \times 100$
Small	155	174	112
Medium	203	304	150
All Farms	179	239	133

Note : See Table A.3b.

Differentials in Cumulative Fertility and Child Survivorship in Rural Bangladesh

by

MOHAMMAD SOHAIL*

The paper identifies some of the demographic, background and socio-economic characteristics of women that affect cumulative fertility and examines the magnitude of differentials in cumulative fertility due to these factors using data from the Bangladesh Fertility Survey. Multivariate techniques are adopted in the analysis to understand the net effect of each of the factors. The results indicate the predominance of demographic variables such as age, age at first marriage and number of times married over other types of variables in the determination of fertility behaviour in rural Bangladesh. However, some of the background and socio-economic variables such as religion, wife's work status and husband's occupation turn out to be significant predictors of fertility behaviour for older women. There is also some indirect evidence to suggest the presence of some kind of involuntary control on fertility behaviour through such mechanism as prolonged breastfeeding, infecundity or sub-fecundity, pregnancy wastage etc. among various sub-groups of the population which are suffering from an extremely poor standard of living.

I. INTRODUCTION

To many authors Bangladesh is experiencing natural fertility and the tage of controlled fertility leading to wide fertility differentials has not yet egun [3 ;19 ; 20]. This is borne out by the evidence of very low use of

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contraception, as low as only ten per cent among the reproductive couples [13]. Some of the earlier studies have nevertheless identified a few differentials in terms of socio-economic and background characteristics of women especially in the context of urban areas [5 ; 6]. The present paper is addressed to the question of fertility behaviour of the rural population and aims at a quantitative identification of the factors that affect their reproductive behaviour. More specifically, the study seeks to (i) explore the selected demographic, socio-economic and background factors that affect cumulative fertility, (ii) determine the magnitude of these effects and the extent to which these effects are explained by compositional differences in the demographic factors or socio-economic and background factors themselves and finally (iii) to explore the relationship between fertility and child survivorship.

In order to select the variables which have statistically significant effects on fertility we tested the effects of a wide range of demographic, background and socio-economic factors. After a careful examination of all possible factors which might have induced change in the fertility behaviour, we have identified a small subset of them which we consider to be crucial both in terms of theoretical importance and statistical significance.

The following eight independent variables have been finally selected for multivariate analysis. The three demographic variables are age, age at marriage, and number of times married ; the sole background variable is religion ; the rest are socio-economic variables, viz. educational attainment of the respondent and her husband, work status of the respondent and occupation of the respondent's husband. Number of children ever born alive and number of children living are the two dependent variables used in this analysis.

There is ample evidence from past studies as well as survey data tha each of the explanatory variables mentioned above has significant relationshi with fertility. Most of this evidence is however based on bivariate analysi and is, therefore, not entirely convincing. But at least it provides an *a prior* justification for including these variables in a multivariate analysis. As sucl a brief reference to this evidence may be in order.

An analysis of all ever-married women of Bangladesh Fertility Surve (BFS) shows that parity rises sharply with age upto age 30 to 4.2 childrer after which the rate of increase slows down reaching the peak of 7.1 childre in the age-group 40-44. Thus age is an important demographic control t

isolate the fertility differentials caused by the more important socio-economic and background characteristics of women.[1]

Age at marriage is also an important socio-demographic factor as it exerts its influence on cumulative fertility by regulating the exposure period for childbearing. Many studies have shown an inverse relationship between age at marriage and cumulative fertility [1; 4].

Patterns of nuptiality directly influence fertility, not only through age at entry into marital union but also through the incidence of marital dissolution and remarriage [16]. The magnitude of this incidence is quite significant in Bangladesh, as the first country report of BFS shows that among all ever-married women 21.5 per cent of first marriages were dissolved, and 60 per cent of those women whose marriages were dissolved had re-married by the time of the survey [4]. Since dissolution may involve a substantial loss of the reproductive period, the number of times a women is married is expected to be inversely related to fertility.

Religious differentials in fertility have been confirmed in many societies, both developed and underdeveloped, by various authors. Stoeckel *et al.* in a study of 15 villages of Bangladesh found that the total marital fertility rate of the Muslims was two births higher than the rate for Hindus [23].[2]

Many studies have isolated the critical role played by education in the process of demographic transition in both the developed and less developed countries [9 ; 14]. BFS data (Appendix Table A.1) show that level of education of both husband and wife are inversely related to mean number of children ever born. But it is not clear whose education is more important—husband's or wife's. Chaudhury found that wife's level of education has a more pronounced negative effect on fertility and positive effect on contraceptive use compared to husband's education [5]. But we propose to use both of them as separate predictors.

Basing on the experience of developed industrialised countries of the world, some scholars argue that greater female participation in the labour force is an essential precondition for a decline in levels of fertility [12 ; 15 ; 18]. However, this pattern is not uniform in the less developed countries, because of

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[1]Some studies have however used either marital duration or years since first marriage as alternative demographic controls. But these are not particularly suitable guides to the risk bearing period of a woman in the specific socio-cultural context of Bangladesh as the BFS data indicate that women who had been married only once had on average an interval of about six months between marriage and its consummation.

[2]BFS data in Appendix Table A.1. shows small differentials between Muslim and non-Muslim fertility. However, non-Muslims exhibit persistently lower fertility than the Muslims at all age groups except for those less than twenty years of age.

the variation in the socio-economic and cultural setting among these countries. Results from Appendix Table A.1 show that women who have ever worked have consistently lower fertility in all the age groups compared to those who have not worked at all. But a recent study of currently married fecund women in a metropolitan city of Bangladesh did not find any relationship between cumulative fertility and work experience of women measured in terms of duration of work since marriage [6]. We have nevertheless included this variable in view of its *a priori* importance.[3]

In developing countries, husband's occupation is often considered the prime indicator of socio-economic status of a family since women are generally confined to familial roles. Three occupation groups are identified in this study—non-agriculturists, landless labourers and owner cultivators. The *a priori* rationale behind this classification lies in an analysis of BFS data which reveals a systematic differential between these three groups. Women whose husbands are engaged in non-agricultural activities tend to have lower fertility compared to the rest, while among the agricultural occupations lowest fertility is associated with the landless labourers (Appendix Table A.1).

The above discussion, based on theoretical reasoning and simple bivariate analysis, should be enough by way of justifying the choice of our explanatory variables for multi-variate analysis. Sources of data and methodology are discussed in the next section. Section III presents the findings on the differentials in cumulative fertility. The relationship between child survivorship and fertility is discussed in Section IV and some concluding observations are made in Section V.

II. DATA SOURCE AND METHODOLOGY

Data Source

Data used in this study are taken from the Bangladesh Fertility Survey carried out during 1975/76. This was the first national survey to collect detailed and comprehensive information regarding births, deaths, nuptiality etc. and the factors affecting these demographic processes.

The Survey adopted three-stage sample design for the rural and urban strata. The first two stages were area selection and the ultimate stage was

[3]Work status of women seems important because rearing of children may compete with leisure time and alternative sources of recreation for working women [11 ; 24]. In addition, the fact of role incompatibility between mother and worker is also presumed to be an important factor [26].

household selection. In the first two stages the selection was done with probability proportional to size and in the last stage selection was done with probability inversely proportional to the number of households. The sample was thus self-weighting within each stratum. Weighting was necessary only for the national and regional estimates. The sampling frames for the first and second stage were provided by the national population census of 1974. The sampling frame for the ultimate stage was done by field mapping.

The sample base for the present analysis consists of 5,410 ever-married rural women between ages 15 and 44. The survey covered all ever-married women under the age of 50 in the sampled households. But the cohort of women aged 45-49 has been excluded from this study because of an odd revealation of the survey to the effect that the mean parity for this cohort was lower than that of the younger one aged 40-44. It is not quite clear at this stage whether this reflects a truly lower fertility for women in the older age-group or is merely an underestimate due to some conventional type of errors such as recall lapse, parity selectivity or age misreporting.

Methodology

The research questions posed in this paper involve a multivariate analysis because we are interested in the net effect of each of the explanatory variables on cumulative fertility after controlling for other variables in the model. Here the explanatory or background variables consist of a mixture of scaled, continuous, dichotomous and categorical variables, sometimes with and sometimes without ordering among the categories, and these variables have a complex pattern of intercorrelations. Considering the variety of varialble types and objectives of the analysis, the hierarchical analysis of covariance and the multiple classification analysis were adopted in the present analysis. The former is a special form of covariance analysis where the covariates and factors are introduced in a predetermined choice of ordering. The advantage of the hierarchical analysis over the classical one is that it facilitates the interpretation of the effects of correlated factors.[4]

The following ordering of the variables was used :

Covariates

Age

Age squared

Age at first marriage

Number of times married

---

[4]For instance, the ratio of the sum of squares for a variable to the total sum of squares provides a partial R^2 measuring the degree of association between the variable and the dependent variable, or the proportion of variance explained by the variable, after adjusting for the previous variables. Accumulation of patrtial R^2 provides a multiple R^2, measuring the proportion of variance explained by all the variables considered upto that stage [8].

Factors

Religion
Husband's education
Wife's education
Wife's work status
Husband's occupation

The covariates are mainly constituted of demographic variables and indicate the risk-bearing period of women. The rationale of putting them prior to the factors is that we are interested in understanding the effects of background and socio-economic factors after adjusting for differential risk-bearing periods of women. As a result, the differentials according to socio-economic variables are net of compositional differences in age, age at first marriage and number of times married.

The order chosen for the factors reflects an implicit causal ordering where each of the factors is adjusted for the previous factor or factors. Religion has been introduced first because people are generally born with a religion, and hence religion may be considered causally prior to all other socio-economic and background factors. It is more likely that the education of husbands will tend to determine the level of education of wives rather than the other way round. This is because marriages are still mostly arranged in Bangladesh and women have very little influence in choosing their partners. Hence, husband's education may be considered causally prior to wife's education. Finally, wife's work status and husband's occupation may be considered causally posterior to religion, husband's education and wife's education, and are thus introduced after these variables.

The Multiple Classification Analysis (MCA) is a special case of multiple regression technique with dummy variables. Here the predictor variables can be as weak as in normal scale of measurement, and non-linear relationship between the predictor and the dependent variable is permissible. The main advantage of the MCA technique is that it provides the grand mean of the dependent variable as its constant term and a set of category means for each factor expressed as deviation from the grand mean as main effects. Expressed in deviation form the category means reflect the magnitude of the effect of each category of factor [2].

We have calculated for each regressor variable two sets of regression equations ; one by including the casually prior variables and the other by including all the variables which also includes casually posterior variables. This will help identify how far the differential due to a particular explanatory variable is explained by either the casually prior or the posterior variables.

Various authors have, of late, questioned the additivity assumption implicit in a regression model using children ever born as the dependent variable and socio-economic factors as independent variables for the whole sample of women in the reproductive period, i.e., women in the 15-44 age-group. Their main contention against this model is that the differentials in cumulative fertility due to various socio-economic factors build up over time as a woman travels through her reproductive period. Hence, we expect interaction between age and socio-economic factors, and obviously a model based on the additivity assumption will be largely inapplicable. With a view to minimising this problem of interaction we have divided the total sample women into two groups, 15-29 and 30-44 age-groups, which may be called younger and older cohorts respectively. Age 30 has been considered as a good cut-off point because, as discussed earlier, the rate of increase in fertility is faster upto age 30 and slows down afterwards. The older cohort thus also roughly represents completed fertility which, in fact, will be our main focus of attention in the analysis of differential fertility.

Measurement of Independent Variables

Following the tradition of the first country report of BFS, religion consists of two categories in the analysis, viz., Muslim and non-Muslim. The non-Muslims are mainly composed of Hindus with a small percentage of Buddhists and Christians.

The level of education of both the respondent and her husband was collected in terms of grades completed. Since level of education is not linearly related to fertility, they are not included in the analysis as continuous variables. Instead, they are represented by the three categories, viz. no schooling, primary and secondary or more. No formal education is represented by no schooling.

Work status of women has been formulated as a composite variable incorporating two different aspects of female work participation since marriage. The first aspect relates to the kind of work she had been doing since marriage. The second aspect is related to the type of employer. Three categories of work status were formulated. First, those who did not work formed the "no work" category. Second, women who worked in non-agricultural activities and were neither self-employed nor a family worker were classified as being in the "Modern Sector". The remainder were classified as belonging to the "Traditional Sector".

As has been mentioned already, three categories of husband's occupation were identified, namely, non-agricultural, landless labourers and owner cultivators. Further classification according to size of landholding was not possible due to lack of data.

III. FINDINGS ON DIFFERENTIALS IN CUMULATIVE FERTILITY

Table I presents for women in the 15-29 and 30-44 age-groups two separate hierarchical analyses of covariance of children ever born on demographic, background and socio-economic characteristics of women in the causal ordering of variables discussed earlier.

TABLE I

HIERARCHICAL ANALYSIS OF COVARIANCE OF CHILDREN EVER BORN

Variable Added at Step	Sum of Squares Added at Step	D.F. Added at Step	Mean Square	F	Partial $R^2 \times 100$	Multiple $R^2 \times 100$
15-29 Age-Group						
Age, Age Squared	8,111.66	2	4,055.83	2,762.83**	58.47	58.47
Age at First Marriage	250.08	1	250.08	170.36**	1.80	60.27
Times Married	264.49	1	264.49	180.17**	1.91	62.18
Religion	27.79	1	27.79	18.93**	.20	62.38
Husband's Education	17.07	2	8.54	5.81**	.12	62.50
Wife's Education	4.04	2	2.02	1.37	.03	62.53
Wife's Work Status	4.42	2	2.21	1.51	.03	62.56
Husband's Occupation	5.39	2	2.70	1.84	.04	62.60
Residual	5,189.40	3,535	1.47			
Total	13,874.34	3,548	3.91			
30-44 Age-Group						
Age, Age Squared	839.75	2	419.87	68.37**	6.51	6.51
Age at First Marriage	.06	1	.06	.01	.00	6.51
Times Married	460.61	1	460.61	75.01**	3.57	10.08
Religion	34.17	1	34.17	5.57*	.27	10.35
Husband's Education	23.38	2	11.69	1.90	.18	10.53
Wife's Education	.76	2	.36	0.06	.00	10.53
Wife's Work Status	84.68	2	42.34	6.89**	.66	11.19
Husband's Occupation	92.05	2	46.02	7.49**	.71	11.90
Residual	11,354.84	1,849	6.14			
Total	12,890.30	1,862	6.92			

*Significant at 0.01 level.

**Significant at 0.001 level.

The hierarchical analysis indicates that age, age at first marriage, times married, religion and husband's education significantly affect fertility behaviour of women in the 15-29 age-group. Age appears to possess the highest explanatory power which alone explains 58.5 per cent of the variance in mean parity out of the total explained variance (62.5 per cent) of all the variables. The second most important correlate of fertility behaviour for this younger cohort is number of times a woman is married which explains an additional 1.9 per cent of the variance after controlling for age and age at first marriage. It is, therefore, evident that the pattern of marital dissolution and subsequent re-marriage is a crucial determinant of fertility behaviour. Next in importance is age at first marriage which exerts considerable influence on cumulative fertility, and explains 1.8 per cent of the variance after controlling for age.

Among the background and socio-economic factors, religion and husband's level of education are seen to have statistically significant effect on human reproduction, although their contributions are very small in both absolute and relative sense—they explain .2 per cent and .1 per cent of the variance respectively after controlling for demographic composition. The remaining socio-economic variables like wife's education, work status and husband's occupation are not significant after adjustment for the previous variables.

For women in the 30-44 age group, age, times married, religion, work status and husband's occupation turn out to be significant correlates of fertility behaviour. As in the case of the younger cohort age still is the best predictor though its contribution in the total explained variance is now reduced a great deal. The number of times married is again the second most important predictor of fertility behaviour, explaining an additional 3.6 per cent of the variance after controlling for age and age at first marriage.

Religious difference among Muslims and non-Muslims accounts significantly for the difference in fertility, and contributes an additional .3 per cent of the variance after adjustment for the demographic composition. Work status and husband's occupation which are not significant predictors for the younger cohort, appear to have emerged as strong correlates of fertility behaviour for the older cohort, and each explains an additional .7 per cent of the variance. However, in contrast to the case of the younger cohort, age at first marriage and husband's education turn out to be non-significant for this cohort, while educational attainment of women remains an insignificant explanatory variable in both the cases.

Finally, it is worth noting that all the factors together explalin 63 per cent of the variance of mean parity for women in the 15-29 age-group compared to only 12 per cent for women in the 30-44 age-group. A part of the

explanation lies in the fact that age explains most of the variance in the younger cohort but substantially less so in the older cohort. Socio-economic factors, however, contribute a greater proportion in the explanation of fertility behaviour of the older women.

Multiple Classification Analysis

We shall now apply multiple classification analysis (MCA) to the BFS data, with a view to (i) examining the magnitude of differentials both before and after all the compositional differences in other variables have been adjusted and (ii) identifying the extent to which the observed differentials may be explained in terms of demographic, background and socio-economic factors. We ask, for example, whether religious differentials in fertility are increased or diminished after the introduction of relevant demographic factors ? To what extent can we explain the educational differentials in fertility by the demographic, background and socio-economic factors ? These are some of the questions that have been posed here.

Two separate MCA analyses were performed on the two cohorts of women aged 15-29 and 30-44 with children ever born as the dependent variable and the selected demorgraphic, background and socio-economic factors as independent variables.

Demographic Variables

Partial regression coefficients for the covariates in the predetermined hierarchical ordering of variables are presented in Table II.

TABLE II

PARTIAL REGRESSION COEFFICIENTS OF THE COVARIATES ADDED IN SUCCESSIVE STEPS

Variable Added at Step	Age Group	
	15-29	30-44
Age	.33	.15
Age Squared	.01	−.01
Age at First Marriage	−.09	00
Times Married	−.82	−.1.19

It can be seen that the effect of age on fertility is more than twice as great for women in the 15-29 age-group as that for women in the 30-44 age-group—mean parity increases by .33 children for the younger cohort compared to .15 children for the older one as age increases by a year.

The quadratic term of age which is significant for both the cohorts of women is positive for the younger women but negative for the older women.

Although age at marriage has a significant negative effect on cumulative fertility for women in the 15-29 age-group, it has virtually no effect on women who are aged 30 or above. In other words, higher age at entry into marital union does not have any perceptible impact on completed fertility though substantial negative effects are observed in the early years of the reproductive period.

We expected a negative association between marital instability and cumulative fertility. The results indicate that for each remarriage, after taking into account age and age at first marriage, parity is reduced on the average by .82 child for women in the 15-29 age-group compared to a reduction of 1.19 children for women in the 30-44 age-group. Much of this relationship can be explained by loss of exposure between marriages for the groups experiencing marriage dissolution. There is also the possibility that less fecund women are more likely to experience divorce or separation and that widowed women may have had much older husbands on average than other women which in turn may have depressed their fertility even prior to widowhood.

The impacts of background factors and socio-economic variables on the mean number of children ever born to women in the two cohorts are documented in Tables III and IV. The column showing 'adjusted for previous variables' indicates for each variable adjusted means after controlling for the variables causally prior to that variable.

Religion

The first panel in the Tables III and IV reveals the extent of fertility differentials by religion. For women in the 15-29 age-group Muslims have the same mean parity of 2.3 children as that of the non-Muslims. However, after adjustment for the previous demographic variables the differentials by religion widens and persists even after adjusting for all the demographic, background and socio-economic variables. This is reflected in the correlation ratio which increases from .01 to .05 after adjustment. Thus it appears that the effect of religion on fertility was suppressed due to the compositional differences in the demographic factors and not because of any of the background and socio-economic factors.

It is interesting to note that while the mean parity for Muslims remained unchanged after adjustment, the mean parity for Non-Muslims went down from 2.3 to 2.1. The explanation for this lies in the compositional differences in the demographic factors such as age, age at marriage and number of times

TABLE III

IMPACT OF SELECTED BACKGROUND AND SOCIO-ECONOMIC CHARACTERISTICS ON MEAN NUMBER OF CHILDREN EVER BORN TO THE YOUNGER COHORT

Characteristics of Women	Number of Cases	Mean Number of Children Ever Born		
		Unadjusted	Adjusted for Previous Variables and Covariates	Adjusted for All Variables
Religion				
Muslim	2,967	2.3	2.3	2.3
Non-Muslim	583	2.3	2.1	2.1
Correlation Ratio		.01	.05	.05
Husband's Education				
No Schooling	2,000	2.3	2.2	2.2
Primary	844	2.3	2.4	2.4
Secondary or More	706	2.3	2.4	2.4
Correlation Ratio		.01	.03	.04
Wife's Education				
No Schooling	2,640	2.4	2.3	2.3
Primary	758	2.2	2.3	2.3
Secondary or More	152	1.4	2.1	2.1
Correlation Ratio		.10	.02	.02
Wife's Work Status				
No Work	3,187	2.3	2.3	2.3
Traditional Sector	239	2.7	2.2	2.3
Modern Sector	124	2.6	2.2	2.2
Correlation Ratio		.06	.02	.02
Husband's Occupation				
Landless Farmer	634	2.0	2.3	2.3
Owner Cultivator	1,474	2.5	2.4	2.4
Non-Agricultural	1,441	2.3	2.3	2.3
Correlation Ratio		.08	.02	.02
$R^2 \times 100$	62.6			
Grand Mean	2.3			
All Women	3.550			

TABLE IV

IMPACT OF SELECTED BACKGROUND AND SOCIO-ECONOMIC CHARACTERISTICS ON MEAN NUMBER OF CHILDREN EVER BORN TO THE OLDER COHORT

Characteristics of Women	Number of Cases	Mean Number of Children Ever Born		
		Unadjusted	Adjusted for Previous Variables and Covariates	Adjusted for All Variables
Religion				
Muslim	1,544	6.5	6.5	6.5
Non-Muslim	320	6.3	6.2	6.2
Correlation Ratio		.03	.05	.05
Husband's Eduction				
No Schooling	1,165	6.4	6.4	6.4
Primary	405	6.8	6.7	6.7
Secondary or More	294	6.4	6.4	6.4
Correlation Ratio		.06	.04	.04
Wife's Education				
No Schooling	1,605	6.5	6.5	6.5
Primary	233	6.5	6.5	6.5
Secondary or More	26	6.2	6.3	6.5
Correlation Ratio		.01	.01	.01
Wife's Work Status				
No Work	1,541	6.7	6.6	6.6
Traditional Sector	238	5.9	6.0	6.1
Modern Sector	85	5.9	5.9	6.0
Correlation Ratio		.10	.08	.07
Husband's Occupation				
Landless Farmer	251	6.5	6.6	6.6
Owner Cultivator	960	6.8	6.7	6.7
Non-Agricultural	653	6.1	6.2	6.2
Correlation Ratio		.13	.09	.09
$R^2 \times 100$	11.9			
Grand Mean	6.5			
All Women	1,864			

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married. The Hindu population is expected to have an older age distribution than the Muslims population because of the considerable outmigration of young Hindus to India after the inception of Pakistan. Moreover, according to BFS data, 23 per cent of the first marriages were dissolved by divorce or death of husband among Muslims compared to only 13 per cent among Hindus. Statistical adjustment for these two factors will thus reduce the mean parity of non-Muslims. Finally, the mean age at first marriage of non-Muslims is 12.7 years as compared to 12.2 years for Muslims. This will have some small inflating effects on mean parity of non-Muslims after statistical control. However, on balance the mean parity of non-Muslims decreases, though only slightly.

In contrast, a considerable differential in fertility on account of religion is observed among women in the 30-44 age-group. The differential is further enlarged after adjustment for the demographic variables and remains unchanged after adjustment for all the variables. Clearly, the increase in the differential is accounted for by the compositional differences in the demographic factors. Since age at marriage does not affect fertility among older women, the factors that may explain this increase are differential age composition and marital instability among Muslims and non-Muslims.

Education

For the younger cohort in Table III, education of women shows a substantial negative effect whereas husband's education has little or no effect on fertility behaviour. As educational level rises mean parity goes down from 2.4 children for uneducated women to 2.2 for the primary school category and to 1.4 children for secondary or higher educated women. However, mean parity for women whose husbands possess varying levels of educational background is the same at 2.3 children.

These patterns, however, change radically as we control for the previous variables. Education of women loses much of its predictive power while differentials by education of husband gain in importance. However, the difference is not substantial, although statistically signfiicant. Obviously, one or more of the causally prior variables have eroded the differentials by education of women and strengthened the differential due to husband's education. For instance, it may be argued that generally the women whose husbands are educated are relatively younger compared to those whose husbands are illiterate since literacy is becoming more widespread among the younger population. Furthermore, husband's education is positively associated with both age at marriage and stability of marriage. Age at first marriage is 11 years for women whose husbands are uneductated compared to 13 years for women

with educated husbands ; also, 27 per cent of women whose husbands are uneducated reported dissolution of their first marriage, whereas the corresponding figure is only 6 per cent for women whose husbands have higher education.

Thus it appears that all the demographic factors are intercorrelated in varying degrees with husband's education and thus affect the differential due to this factor. It is evident that the control of age and age at marriage will increase the mean parity for women whose husbands are educated while the control of marital stability will tend to reduce the mean parity for these women. On balance, statistical adjustment of these two opposing forces increases the differential in fertility leading finally to the emergence of a slightly positive association between husband's education and fertility.

Similarly, eduation of women is positively correlated with age and age at marriage. The mean age at marriage is 12 years for illiterate women as compared to 15 years for educated women. Again, education is negatively associated with dissolution of marriage—24 per cent of the first marriages being dissolved for uneducated women compared to only 9 per cent for the educated women. Higher age at marriage of educated women probably has stronger effects on their fertility than the effect of marital dissolution. Hence after adjustment, mean parities rise for educated women and lead to the disappearance of statistically significant fertility differentials by education.

When we turn to the differentials in fertility on account of education among the older cohort of women in Table IV, we find that the differentials due to husband's education are quite pronounced while there exists no relationship between education of women and their fertility.[5] However, the differentials due to husband's education are reduced after being adjusted for the previous variables and turn out to be statistically insignificant in affecting cumulative fertility.

To summarize, although educational attainment of husbands has a minor positive effect on fertility for women in the younger cohort, education of neither of the partners significantly affects fertility among the older women.

Wife's Work Status

In the younger cohort, the unadjusted figures suggest that work status may have an appreciable influence on fertility behaviour, with working women having higher mean parity compared to non-working women. This is contrary to our

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[5]Interestingly enough, the relationship that is observed between fertility and husbands' educational attainment is one of inverted U-shaped pattern.

expected relationship. However, after adjustment for the previous variables the relationship turns out in the right direction, but it now ceases to be statistically significant.

One explanation may be that working women are relatively older compared to non-working women because of social prohibitions facing younger women against participation in the work force. On the other hand, since the working women generally come from lower socio-economic strata they are likely to have experienced greater degree of marital dissolution, and also a greater proportion of their husbands are likely to be uneducated. The net result of these two opposing forces probably cancel each other out with the result that there does not exist any significant differential among the three categories of work status.

The relationship is, however, in the expected direction in the case of the older cohort. Non-working women have a higher mean parity of 7 children compared to 6 for women who have worked since marriage in either the traditional or modern sector. After adjustment for the previous variables the differential is reduced, but only slightly.

Now, in addition, if we adjust for husband's occupation, fertility differentials among the three categories of work status is further reduced, although again very slightly. This is because husbands of working women are likely to belong in greater proportion to the non-agricultural sector which has been found to be associated with lower fertility. It nevertheless appears that after adjustment for all the variables, non-working women still have a higher mean parity of 6.6 children compared to 6 children for the working women.

Regarding differential among the working women, it is of interest to note that, although women belonging to the 'traditional sector' have a slightly higher mean parity than the women belonging to the 'modern sector', this difference is not statistically significant.

Husband's Occupation

The unadjusted figures indicate appreciable differentials in fertility between the three categories of husband's occupation for women in the 15-29 age-group. Owner cultivators have the highest mean parity followed by non-agricultural occupations and the landless labourers, in that order. This goes contrary to our expectation because landless labourers belong to the lowest class in the socio-economic ladder in the society and hence are expected to have the highest fertility. However, after adjustment for the previous variables the differentials among the three categories largely disappear. Hence, the variation in mean parity has been largely explained by the variation in demographic

composition and husband's education. The mean age of women whose husbands are landless, owner cultivators and non-agriculturists, are 26 years, 29 years and 27 years respectively showing that the landless women are the youngest among the three groups.

In addition, since the landless people come from lower socio-economic status their wives might have experienced greater marital instability compared to other two groups. The rate of education among the landless is also lower. In fact, we find that percentage educated among landless, land owners and non-agriculturists is 28, 43 and 49 respectively. Thus the combined effects of these factors diminish the fertility differentials on account of husband's occupation to statistical insignificance.

Now if we turn to women aged 30-44, the observed differentials are much sharper compared to the younger cohort. The results reveal that owner cultivators have the highest mean parity of 6.8 children, followed by landless farmers having 6.5 children and non-agricultural occupations having the lowest mean of 6.1 children. Owner cultivators still have higher fertility than the landless in terms of completed fertility. However, it appears that the main difference is between the owner cultivators and non-agricultural occupations. After adjustment for all the previous variables the difference between the agricultural categories is reduced resulting in overall reduction in differentials among the three categories. The differential is also reduced between the agricultural and non-agricultural occupations but still a large difference of almost half a child is maintained between them. These adjusted differences are statistically significant.

The reduction in the differentials is probably due to the combined effects of age, marital instability and work status. The greatest effect is probably made by work status of women since the percentage of women working since marriage varies considerably among the three groups, which is 20 per cent for landless, 5 per cent for land owners and 12 per cent for non-agricuituraists.

To summarise this section, a few comments are in order. We have noted that the differentials that have been observed for younger women often change both in terms of direction as well as in magnitude as women attain their completed fertility. It is also noticed that the differentials in fertility among younger women is mostly explained by the compositional differences in demographic variables whereas the differentials among older women have largely remained unexplained. Furthermore, differentials by certain important socio-economic characteristics which do not emerge for younger women are later considered to be crucial in the determination of fertility behaviour in terms of completed family size.

IV. CHILD SURVIVORSHIP AND CUMULATIVE FERTILITY

According to the child replacement hypothesis the incidence of high mortality in a family will result in a high reproductive performance. It is argued that when a child dies parents will respond to the event by attempting to replace the child as quickly as possible. If this hypothesis holds we should expect a differentiated cumulative fertility pattern or no difference in surviving children due to the incidence of differential mortality or child survivorship. Evidence from rural India suggests a balance between fertility and mortality within social classes. Mortality is the lowest in the highest social class where fertility is also the lowest. As a result, the mean number of living children by marriage duration shows no real variation among the social classes [17].

Although it is established that the levels of fertility and mortality are highly intercorrelated, the direction of causation between them cannot be clearly spelt out [22]. Taylor *et al.* question the existence of a direct causal link between the decline of child mortality and decline in fertility that is implied by the child survival theory [25]. They provide instances in which reduced child mortality may not have been a precondition for lower fertility. In an interesting analysis of the two South Asian societies of Pakistan and Bangladesh with moderately high levels of fertility and mortality Alauddin *et al.* found no evidence that child deaths generate a desire to replace them [7]. They observed no significant difference in length of birth intervals between women who had experienced at least one child death and who had not (excluding child deaths just prior to the birth intervals examined). Consequently they argued that the reverse situation may be true ; high fertility may contribute to high mortality.

As against this contrary documentation, the demographic literature abounds with examples of situations in which mortality appears to have a significant positive effect on fertility [10 ; 21].

In order to test this hypothesis in the context of Bangladesh, separate regressions were performed on the number of living children using the selected demographic, background and socio-economic regressor variables. It was argued earlier that if the child replacement theory operates then there would be differentials in cumulative fertility due to differential child survivorship. By the same logic, if the theory holds we expect that there will be no difference in surviving children due to the incidence of differential child mortality or child survivorship. This hypothesis can be tested from the results in tables V and VI which show the MCA analyses of children ever born and living children by the selected variables for the two cohorts of women.

The findings indicate that the differentials in living children by the selected background and socio-economic factors still persist, and the differentials in mean number of living children are occasionally more pronounced compared to the differentials in mean number of children ever born. In addition, the factors that affect mean living children are almost identical to the factors that affect mean parity in both the cohorts (see Appendix Table A.2).

TABLE V

CHILD SURVIVORSHIP AND FERTILITY FOR YOUNGER COHORT

Characteristics of Women	Number of Cases	Children Ever Born	Children Currently Living	Per Cent of Children Surviving
Religion				
Muslim	2967	2.3	1.8	78
Non-Muslim	583	2.1	1.6	75
Partial Correlation Ratio		.05	.06	
Husband's Education				
No Schooling	2000	2.2	1.7	76
Primary	844	2.4	1.8	78
Secondary or More	706	2.4	2.0	81
Partial Correlation Ratio		.04	.07	
Wife's Education				
No Schooling	2640	2.3	1.8	77
Primary	758	2.3	1.8	79
Secondary or More	152	2.1	1.6	77
Partial Correlation Ratio		.02	.02	
Wife's Work Status				
No Work	3187	2.3	1.8	78
Traditional Sector	239	2.2	1.6	75
Modern Sector	124	2.3	1.6	71
Partial Correlation Ratio		.02	.03	
Husband's Occupation				
Landless Farmer	634	2.3	1.8	78
Owner Cultivator	1474	2.4	1.8	77
Non-Agricultural	1441	2.3	1.8	77
Partial Correlation Ratio		.02	.02	
R^2		62.6	57.3	
Grand Mean		2.3	1.8	
All Women	3550			

It appears from Table V that the mean number of living children is higher for Muslims than for non-Muslims. But it can also be seen that this differential is slightly higher compared to the differential in mean parity. This indicates that Mulsims have a slightly higher survival rate of children than non-Muslims. Clearly, this result does not conform to the child replacement hypothesis which predicts that there should not be any differential in living children due to differential child survivorship.

The table also shows that positive association between husband's education and living children is considerably stronger compared to the relationship between husband's education and mean parity. This again indicates a positive association between cumulative fertility and child survivorship. Wives of illiterate husbands have a mean parity of 2.2 children and a survival rate of 76 per cent compared to wives of educated husbands, who have a mean parity of 2.4 children and survival rate of 81 per cent.[6]

We now turn to an analysis of the significant factors for women in the 30-44 age-group in Table VI. As in the case of the younger cohort, differential in living children by religion slightly increases due to slight differential in survival rate. The positive association between cumulative fertility and child survivorship is thus again maintained.

Work status is a highly significant factor in affecting both cumulative fertility and living children. Here again one can notice a positive association between fertility and child survivorship among the non-working and working women, with the exception of women working in the modern sector.

There is also a positive association between mean parity and child survivorship among two categories of husband's occupation namely, landless labourers and non-agriculturists. On the other hand, although owner cultivators have lower survival rate compared to the landless labourers they have almost the same mean number of living children and children ever born. Hence no uniform relationship is observed between cumulative fertility and child survivorship among all the categories of husband's occupation.

From the above analysis it appears that in general there is a positive association between cumulative fertility and survivorship with some minor exceptions. The differentials in mean living children are as high as or even higher than the differentials in mean parity. This is because the differentials

[6]As discussed earlier, wife's education and work status and husband's occupation have not been found to be significant predictors of fertility behaviour for women in the 15-29 age-group and hence these factors have been excluded from further discussion.

in child survival rates by various socio-economic factors are not large enough to have marked effects on cumulative fertility. Hence, the child replacement hypothesis is probably not valid in the rural society of Bangladesh.

TABLE VI

CHILD SURVIVORSHIP AND FERTILITY FOR THE OLDER COHORT

Characteristics of Women	Number of Cases	Children Ever Born	Children Currently Living	Per Cent of Children Surviving
Religion				
Muslim	1544	6.5	4.9	74
Non-Muslim	320	6.2	4.5	73
Partial Correlation Ratio		.05	.06	
Husband's Education				
No Schooling	1165	6.4	4.7	73
Primary	405	6.7	5.0	76
Secondary or More	294	6.4	4.9	76
Partial Correlation Ratio		.04	.06	
Wife's Education				
No Schooling	1605	6.5	4.8	74
Primary	233	6.5	5.0	77
Secondary or More	26	6.5	5.4	82
Partial Correlation Ratio		.01	.05	
Wife's Work Status				
No Work	1541	6.6	4.9	74
Traditional Sector	238	6.1	4.4	72
Modern Sector	85	6.0	4.6	77
Partial Correlation Ratio		.07	.07	
Husband's Occupation				
Landless Farmer	251	6.6	5.0	76
Owner Cultivator	960	6.7	5.0	74
Non-Agricultural	653	6.2	4.6	74
Partial Correlation Ratio		.09	.09	
R^2		11.9	9.0	
Grand Mean		6.5	4.8	
All Women	1864			

V. SUMMARY AND CONCLUSION

The foregoing analysis of differential fertility reveals that the demographic factors still play a predominant role in the determination of reproductive behaviour in rural Bangladesh. Of all the variables examined in this study, age may be singled out as the strongest predictor of fertility behaviour. It may be noticed, though, that as women become older the importance of age is gradually diminished, and other factors come increasingly to play a more singnificant role. Next to age, the most important factor is the number of times a woman is married which is again a demographic variable.

Among the background and socio-economic variables, religion, work status of women and husband's occupation are found to have significant impacts on cummulative fertility. Husband's educational attainment though have significant effects for younger women, the differentials by husband's education are not statistically significant for the older cohort. Education of women themselves turns out to be an insignificant factor in both the cohorts. Husband's occupation is not so important for the younger women, but for the older cohort it has a statistically significant impact on fertility. Of particular interest is the finding that women whose husbands are owner cultivators have slightly higher mean parity than the women whose husbands are landless labourers, even after adjusting for all the variables. This may largely be attributed to the biological and cultural factors that are operating in the rural society of Bangladesh. In other words, the fertility of the landless labourers is depressed due to a combination of nutritional-cultural factors since acceptance of contraception is not significantly higher for this group.

For instance, the cultural practice of prolonged breastfeeding of child which often operates as a chief contributory factor to long birth interval in Bangladesh, is probably more common among this class which represents the poorest section of the community. In addition, lack of an adequate nutritional standard might have contributed to higher infecundity or subfecundity among this group. They might have suffered also from higher pregnancy wastage due to malnutrition.

Thus the lower fertility of the landless suggests the presence of some kind of involuntary controls on fertility under extremely poor living conditions. The slightly higher fertility of the owner cultivators seems to indicate that some of these involuntary controls have weakened in their case as a result of higher economic wellbeing and nutritional standard.

The final interesting finding relates to the highly popular child replacement hypothesis. Although not all the evidence point to the same direction the balance of evidence suggests that this hypothesis does not probably apply in the rural society of Bangladesh.

Finally one might conclude with the observation that there exists in rural Bangladesh some forces capable of reducing fertility, while there are others which may push fertility up temporarily. In particular, higher standards of living may lead to less adhereance to culturally necessary institutions of involuntary controls and the physiological restraints imposed by extereme poverty. Probably, the impact of these fertility inflating forces will continue to be more widely felt in the near future because of the lack of widespread education and female labour force participation.

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Appendix

TABLE A. 1

MEAN NUMBER OF CHILDREN EVER BORN TO ALL EVER MARRIED WOMEN, BY CURRENT AGE AND SOCIO-ECONOMIC AND BACKGROUND VARIABLES—BFS, 1975/76

Background Variable	Current Age					
	<20	20-24	25-34	35-44	45-49	Total
Religion						
All	0.7	2.4	4.8	6.9	6.7	4.0
Muslim	0.7	2.5	4.9	6.9	6.9	4.0
Non-Muslim	0.8	2.3	4.5	6.8	6.1	3.9
Husband's Education						
All	0.7	2.4	4.8	6.9	6.8	4.0
No Schooling	0.7	2.3	4.9	6.8	6.7	4.0
Primary	0.7	2.6	4.9	7.2	6.8	4.0
Secondary	0.7	2.7	4.7	7.2	7.2	3.8
Higher	0.7	1.9	4.4	6.6*	6.3*	2.8
Education						
All	0.7	2.4	4.8	6.9	6.7	4.0
No Schooling	0.7	2.5	4.9	6.9	6.7	4.2
Primary	0.7	2.6	4.7	7.1	6.9*	3.4
Higher	0.6	1.9	3.8	6.6*	7.6*	2.4
Work Status						
All	0.7	2.4	4.9	6.9	6.7	4.0
Did not Work	0.7	2.5	4.9	7.1	7.0	3.9
Worked	0.6	2.3	4.7	6.1	5.5	4.2
Husband's Occupation						
All	0.7	2.4	4.8	6.9	6.7	4.0
Unclassified	0.6	2.2	4.9	6.5	6.1	3.6
White Coller	0.8	2.4	4.7	6.6	6.5	3.8
Cultivator Own Land	0.7	2.6	5.0	7.1	6.8	4.3
Cultivator Other	0.8	2.8	5.2	7.3	7.5*	4.4
Landless Labour	0.7	2.2	4.8	7.1	7.1	3.7
Other	0.88	2.3	4.6	6.5	6.2*	3.6

*Cell frequency less than 50 women.

Source : Table 6.5 and Table 6.8, First Report, Bangladesh Fertility Survey.

TABLE A. 2

HIERARCHICAL ANALYSIS OF COVARIANCE OF LIVING CHILDREN

Variable Added at Step	Sum of Squares Added at Step	D.F. Added at Step	Mean Square	F	Partial R^2 x100	Multiple R^2 x100
15-29 Age-group						
Age, Age Square	4748.19	2	2379.10	2188.64**	52.86	52.86
Age, at First Marriage	111.39	1	111.39	102.48**	1.24	54.10
Times Married	207.13	1	207.13	190.56**	2.30	56.40
Religion	23.15	1	23.15	21.29**	.26	56.66
Husband's Education	45.15	2	21.08	19.39**	.47	57.13
Wife's Education	4.70	2	2.35	2.16	.05	57.18
Wife's Work Status	9.50	2	4.75	4.37*	.11	57.29
Husband's Occupation	2.71	2	1.36	1.25	.03	57.32
Residual	3842.39	3535	1.09			
Total	9001.31	3548	2.54			
30-44 Age-group						
Age, Age Square	307.98	2	153.99	35.06**	3.45	3.45
Age at First Marriage	3.36	1	3.36	0.77	.04	3.49
Times Married	279.25	1	279.25	63.58**	3.13	6.62
Religion	30.86	1	30.86	7.02*	.34	6.96
Husband's Education	50.78	2	25.39	5.78*	.57	7.53
Wife's Education	9.63	2	4.81	1.10	.11	6.64
Wife's Work Status	57.64	2	28.82	6.56**	.65	8.29
Husband's Occupation	63.71	2	31.86	7.25**	.71	9.00
Residual	8121.03	1849	4.39			
Total	8924.24	1862	4.79			

*Significant at 0.01 level.

**Significant at 0.001 level.

The Defectiveness of the 1974 Population Census of Bangladesh

by

SHARIFA BEGUM AND ARMINDO MIRANDA*

This paper critically evaluates the plausibility and consistency of various findings of the 1974 Census of Bangladesh. However, the objective of the paper is not merely to reveal the defects *per se*. It purports to show how the methodology of research on various issues relating to population statistics can be significantly affected by the interpretation one gives to the data discrepancies and by the manner in which one attempts to correct those discrepancies. This is done as a part of a larger study which aims at analysing the mechanisms through which research, policy making and administration adjust to and thrive on poor quality of statistical data.

I. INTRODUCTION

The present article is part of a larger study on the status of demographic data in Bangladesh. In that study, the analysis of the 1974 Census is only meant to provide illustrative evidence for the discussion of a broader set of issues, located at the frontier of the "sociology of statistical knowledge" rather than within the realm of statistical or demographic analysis *per se*. In fact, the authors feel that the debate on the accuracy of the figures or on the quality of the statistical data in abstract terms is bound for an unconclusive deadlock for at least two reasons :

First, one of the features of the present data situation in Bangladesh is that statistics can hardly be assessed by reference to statistics ; apart from signalling the most obvious instances of data defectiveness and perhaps

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setting a question mark here and there when the errors are less evident, there is little the analyst can do to measure the quality of the figures. Data from different sources do not usually "interact" well both because they fail to convince the user of their specific reliability and because, as a rule, they are not meant to serve comparative purposes. Institutionally, this is reflected in the absence of dialogue between the different suppliers of data and even between different data production endeavours carried out by the same agency.

Secondly, we believe that the nature of the data defectiveness issue in developing countries does not let itself capture in purely methodological terms. There is hardly anything particularly intriguing about the shortcomings of the data—at least in the sense that these shortcomings can be detected and explained, given the proper amount of curiosity and resources to carry out the task. The patterns of defectiveness are in addition quite stable—there is no element of surprise in, say, the poor quality of age data or the uncertain degree of completeness of the census. What remains an intellectually stimulating problem is how a society adapts to the poor quality of the statistical data it produces ; how can research, policy making and administration thrive on figures of dubious plausibility, never fully accepted nor consistently rejected; what are the functional linkages of the data production process to the society at large. The following pages should be read with this framework in mind.

II. CENSUS PUBLICATION STRATEGY : TIMING AND CONTENTS OF THE CENSUS PUBLICATIONS

Between October 1974 and the end of 1977, the Census Commission released four separate sets of data—three "Census bulletins" and a batch of publications titled "Village Population Statistics."

The *first bulletin* was released in October 1974, seven months after the census reference date. It contained one main table—a head-count of the population by sex at the district and subdivision level—and a few subsidiary tables, graphs, charts and maps purporting to facilitate the reading of the main table.

The *second bulletin* was published in March 1975, exactly one year after the enumeration—and for nearly three years, until the publication of the *National Volume*, it was to remain the only source of census data of significant interest for general research purposes. It contained nine tables, whose scope could be summarized under the following headings : total population ; population density ; sex ratio ; age structure (in three age groups) ; labour force ; literacy; urban and rural population figures ; number of households. In most cases, corresponding data from the 1961 Census

were recalled, helping the reader to make comparisons and identify possible trends. All figures were considered to be subject to final revision, except the data on total population by sex—a distinction which, in fact, did not imply any qualitative judgement on the respective levels of accuracy of the figures ; it merely reflected the technical impossibility of adjusting total population data any further on the basis of the available census returns.

The *third bulletin* was published in April 1976, more than two years after the Census. It was titled *Union Population Statistics* and contained two tables : one table showing the total population by sex, the number of literates and the number of households enumerated in each *union* and another table displaying the same information exclusively for the urban areas of the individual *unions*.

The set of volumes called *Village Population Statistics*, whose publication was undertaken after the release of the *third bulletin*, merely restated the already available information (area, population by sex, number of literates and number of households), only this time at the village level.

All these publications have a point in common : they resulted from the processing of the *tally sheets*, documents in which the enumerators had compiled and summarized data from the individual census forms pertaining to their block. The primary data being thus already returned in aggregated form from the field, alternative cross-tabulations of individual characteristics were necessarily out of question. The only avenue open for further processing of the data consisted in exploring various levels of geographical focus—and efforts in this direction appear to have been pursued beyond the limits either inherent to the nature of the data or suggested by research and policy-making requirements and priorities. This resulted in a peculiar situation where more than three and a half years after the Census were taken, one was submerged with village-level figures of modest significance while being unable to obtain a few basic, nation-wide figures on marital status, education or employment cross-tabulated by age and sex.

The only publication based on the individual census forms was made available to the public in the first months of 1978 and it marked the end of the 1974 Census processing programme. It contained a report giving insights on the technical aspects of the census and discussing the results mainly in relation to data from previous censuses and surveys but also in an international perspective, by comparison to other countries. The much awaited census reslults consisted in a set of 22 tables providing data on conventional topics (age, sex, marital status, religion, mother tongue, place of birth, literacy,

occupation and fertility), almost always detailed at the district level and distinguishing between urban and rural areas.

Later on in this paper, we will try to examine the specific question of the quality of census data. For the moment, as we take issue with the census publication strategy, what interests us is whether the quality of the *tally sheets* (upon which the releases prior to the *National Volume* were based) warranted the extensive use that was made of them. In retrospect, the answer is undoubtedly no. Apart from the data on surface area and the figures of total population, which were not challenged by the *National Volume*, every other single item in those census releases appeared to be at variance—sometimes at great and devastating variance with the (presumably) more authoritative results of the *National Volume*.[1]

Table I highlights one aspect of these discrepancies, specifically in the area of age and sex structures. Roughly speaking, the *National Volume*[3] deflates figures in *Bulletin No. 2* [6] for the age group 5—9, redistributing the "excess" population in the other age groups. For unidentified and, as things stand, unidentifiable reasons, the largest discrepancies involve males in the age group 5—9, but to a smaller or greater extent, there are discrepancies in all figures for both sexes, for every age group, in every district. In the case of a few districts, also the 0-4 age group appears to have been deflated ; only the population aged 10 and over in all instances stands as net beneficiary of the transfers from children's age groups.

Leaving aside for the moment the very real possibility that both sources are irredeemably wrong, the disturbing fact is that even a relatively crude age/sex distribution in three age groups seems to have exceeded the analytical capacity of the *tally sheets*. As we will see in the next section, the reassessment of the age structure operated by the *National Volume* is, from a commonsense point of view, welcome—as it corroborates the suspicion of artificial inflation of the age group 5—9 suggested by a quick look at figures in *Bulletin No. 2*. Yet, the point is that such a "reassessment" was obtained as far as one knows, in a totally involuntary manner, prior to any attempt to correct the figures for omissions and misreporting. Whatever uncertainties there are regarding the accuracy and completeness of the census, they come on the top of the "divergence of opinion" (which, in this case, involves about half a million children in the age group 5-9) between different census data releases.

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[1]These discrepancies have been noted by Stan D'Souza [8].

TABLE 1

COMPARISON OF THE AGE AND SEX STRUCTURES IN TWO CENSUS SOURCES (BULLETIN NO. 2 AND "NATIONAL VOLUME")

Districts	MALES[1]			FEMALES[1]			SEX RATIOS					
	Age 0-4	Age 5-9	Age 10&+	Age 0-4	Age 5-9	Age 10&+	Age 0-4 Bull.2	Age 0-4 Nat.Vol.	Age 5-9 Bull.2	Age 5-9 Nat.Vol.	Age 10&+ Bull.2	Age 10&+ Nat.Vol.
Chittagong	—4.9	—8.5	3.4	5.1	—4.0	—0.2	110	100	111	105	118	122
Ctg. Hill Tracts	1.1	—6.8	1.2	1.3	—3.6	—0.6	102	102	107	104	120	121
Comilla	0.8	—5.2	1.3	0.2	—3.1	0.9	100	101	105	103	110	110
Noakhali	0.6	—5.6	1.5	1.0	—3.6	0.8	101	100	106	103	105	107
Sylhet	2.7	—4.8	0.7	2.7	—2.5	0.1	98	101	101	99	111	111
Dacca	0.9	—8.1	1.9	1.3	—3.5	0.7	99	99	106	101	121	123
Faridpur	0.6	– 6.5	1.8	1.6	—4.3	0.8	101	100	105	102	108	108
Mymensingh	1.0	—4.0	0.9	0.2	—3.2	1.0	98	98	101	100	111	111
Tangail	1.9	—5.9	1.3	—1.0	– 4.0	1.5	99	102	102	100	109	109
Barisal	1.7	—6.2	1.2	—1.4	—4.2	0.8	100	101	103	100	109	109
Jessore	1.5	—2.6	0.5	0.8	—2.3	0.6	100	101	103	102	109	108
Khulna	1.1	—4.0	0.8	2.7	—1.4	—0.2	100	98	102	99	113	115
Kushtia	—0.1	—3.9	1.2	2.1	—3.9	0.7	101	99	104	104	109	109
Patuakhali	—0.8	—4.4	1.4	—1.2	—2.6	1.1	99	99	99	98	106	106
Bogra	3.6	—3.5	0.1	2.5	—1.3	—0.3	97	98	100	98	107	107
Dinajpur	3.3	—4.8	0.6	3.1	—3.3	0.2	99	99	101	99	113	113
Pabna	2.2	—2.9	0.3	3.2	—3.6	0.3	99	98	103	104	110	110
Rajshahi	—1.0	—4.0	1.5	0.2	—3.5	1.2	99	98	103	102	106	106
Rangpur	0.5	—4.6	1.3	0.5	—1.4	0.3	99	99	103	100	110	111
Bangladesh	0.7	– 5.2	1.3	1.4	—3.1	—0.6	100	99	103	101	111	112

(1) Differences *National Volume* minus *Bulletin 2* in percentage of *Bulletin 2* values.

Sources : [6 Table 5] and [3, Table 4].

The second topic explored by *Bulletin No. 2*—literacy by sex—was equally subject to a drastic reassessment in the *National Volume*. The tally-sheet based figures of *Bulletin No. 2* showed a decline of literacy rates for males in six districts and no growth in two other districts—a surprising but perhaps not altogether implausible result, considering the demographic and socio-economic circumstances that had prevailed in Bangladesh during the intercensal period. Not that one knows much about these circumstances in terms of statistical evidence—but given the standard doomsday picture of social development in the country, one would certainly be inclined to accept any figures adding substance to one's negative preconceptions. The geographic pattern of literacy trends also had a certain quality of neatness : literacy rates for males had declined or stagnated in an area formed by a continuous stripe of districts from Rajshahi to Comilla, through Bogra, Dinajpur, Rangpur, Tangail, Mymensingh and Sylhet. The *National Volume*, however, added 3 points on average to *Bulletin No. 2* literacy rates (Table II) : out of the six districts where literacy first appeared to have declined, only one district, Comilla, still showed such a trend. Finally, one could doubt as to whether any speculation on the magnitude and the causes of the literacy decline would have been founded and appropriate at all.

In fact, as Table III documents, the reassessment of the number of literates was even more considerable than what the comparison of literacy rates might suggest. The differences between the two sources amount to 1.2 million literates, which is about 9% of the total. At the district level, the relative differences—which are particularly large for female literates—are often in excess of 10%.

Like for the data on the age and sex structure, one ignores the reason for the discrepancy between the two sources. Although the magnitude of the differences might greatly vary from district to district, there are general patterns (deflation of the age group 5—9, inflation of the number of literates) which are too systematic to suggest that one is dealing with some sort of sampling error. It seems more plausible that field-workers and desk-workers might have had different "views" on the question of age, on the question of literacy and so on, due to inadequate training and improper supervision and co-ordination.

As far as literacy is concerned, an important aspect of the "reassessment" operated by the *National Volume* is that the differences between the two sources in 1974 in many cases are greater than the differences between 1961 and 1974, as assessed in *Bulletin No. 2* : while the increase in literacy rates during the intercensal period amounted to less than 1 percentage point for

males, the difference between the two 1974 sources stood at 3 percentage points. If, as we presume, the discrepancies between *Bulletin No. 2* and *National Volume* are essentially due to "differences of opinion" in the processing of the data, then any trend analysis at the district level appears as a rather speculative, not to say meaningless exercise.

TABLE II

COMPARISON OF LITERACY RATES AND LITERACY TRENDS 1961-74 ACCORDING TO TWO 1974 CENSUS SOURCES

Districts	Literacy Rates (%)				Variation 1961-74 (in percentage points)			
	MALES		FEMALES		MALES		FEMALES.	
	Bull.2	Nat. Vol.	Bull.2	Nat. Vol.	Bull.2	Nat Vol.	Bull.2	Nat Vol.
Chittagong	38.5	39.6	19.7	15.8	2.6	3.7	8.2	4.3
C. Hill Tracts	26.3	28.4	8.6	9.0	4.2	6.3	5.2	5.6
Comilla	32.2	34.0	14.5	14.8	—3.1	—1.3	2.4	2.7
Noakhali	35.6	36.9	16.1	15.8	1.0	2.3	4.5	4.2
Sylhet	27.6	30.0	12.2	12.6	—0.8	1.6	2.6	3.0
Dacca	33.7	38.7	17.4	19.9	2.8	7.8	5.7	8.2
Faridpur	28.2	30.0	11.9	12.6	3.1	4.9	4.8	5.5
Mymensingh	20.6	23.8	9.5	11.3	—1.4	1.8	1.7	3.5
Tangail	24.8	27.7	10.4	11.8	—0.3	2.6	2.7	4.1
Barisal	37.5	40.6	23.3	24.1	3.4	6.5	9.6	10.4
Jessore	31.3	34.7	12.9	15.3	3.2	6.6	5.0	7.4
Khulna	37.9	42.4	18.1	21.2	1.6	6.1	5.9	9.0
Kushtia	22.6	24.8	10.6	12.1	1.4	3.6	3.5	5.0
Patuakhali	36.6	39.9	18.4	19.7	8.0	11.3	9.7	11.0
Bogra	30.7	34.6	13.1	15.2	0	3.9	3.7	5.8
Dinajpur	31.4	36.4	10.6	12.1	—4.8	0.2	2.7	4.2
Pabna	22.2	24.5	9.8	10.9	0.3	2.6	1.3	2.4
Rajshahi	26.9	30.6	11.4	13.0	0	3.7	3.1	4.7
Rangpur	23.8	27.0	8.1	9.6	—1.7	1.5	2.0	3.5
Bangladesh	29.9	32.9	13.7	14.8	0.6	3.6	4.1	5.2

Sources : [6, Statement 6.1] ; [3, Table 11].

Notes : Literacy defined as ability to "read and write a simple letter in any language". Literacy rates calculated as percentage of literates among the population aged 5 years and above.

It would certainly have been important to addresss the substantive issue of literacy trends and discuss the possibilities and limitations of census data for this purpose. Such a debate, however, did not take place. The statistical apparatus of the country learned so little about the data it produced

TABLE III

NUMBER OF LITERATES BY DISTRICT; BULLETIN NO. 2 AND NATIONAL VOLUME

Districts	MALES			FEMALES		
	Bull.2	Nat. Vol.	% Difference Nat. Vol./ Bull.2	Bull.2	Nat. Vol.	%Difference Nat. Vol./ Bull. 2
Chittagong	746,356	775.228	3.9	328,363	260,812	—20.6
Chittagong Hill Tract	60,934	65,627	7.7	16,917	17,654	4.4
Comilla	814,006	857,456	5.3	338,486	344.176	1.7
Noakhali	493,570	510,563	3.4	210,796	206,224	—2.2
Sylhet	574,948	622,485	8.3	232,854	239,153	2.7
Dacca	1,165,768	1,333,895	14.4	511,650	582,229	13.8
Faridpur	492,774	523,478	6.2	194,722	205,527	5.5
Mymensingh	679,276	779,577	14.8	287,975	339,430	17.9
Tangail	223,971	248,866	11.1	87,916	99,117	12.7
Barisal	633,092	683,078	7.9	351,052	379,050	8.0
Jessore	449,906	495,568	10.1	173,038	204,698	11.8
Khulna	598,239	667,352	11.6	258,214	300,782	16.5
Kushtia	183.194	200,769	9.6	79,914	90,284	13.0
Patuakhali	230,919	252,275	9.2	110,879	119,352	7.6
Bogra	290,982	324,505	11.5	117,184	135,978	16.0
Dinajpur	352,225	404,904	15.0	108,384	122,303	12.8
Pabna	267,683	294,458	10.0	109,382	121,159	10.8
Rajshahi	487,113	552,233	13.4	196,172	222,661	13.5
Rangpur	555,811	630,156	13.4	173.943	207,306	19.2
Bangladesh	9,300,767	10,222,473	9.9	3,887.841	4,197,895	8.0

that even the discrepancies between *Bulletin No. 2* and *National Volume* seem to have passed unnoticed. As late as by the end of 1979, Bangladesh Bureau of Statistics' publications were still quoting figures indifferently from either

source,[2] perhaps unaware of the fact that the two sets of data are inconsistent with each other.

The third topic highlighted in *Bulletin No. 2*—employment and labour force structure—is the one that now appears to have received the most drastic mistreatment, judging from the comparison with *National Volume* data. The conflict between the two data sets is so blatant (Table IV) that only a few figures ("total male labour force" and "total males employed") can be considered to present discrepancies of substantial size ; for all other figures, particularly those concerning the female labour force, it seems more appropriate to say that the two sets of data simply bear no relationship to each other.

Since *Bulletin No. 2* data were used in a few pieces of demographic literature (which it would be unfair to single out here), one might wonder with discomfort about the status of the research findings and policy conclusions the authors might have inferred from these statistics. As shown in Table V, the two sets of data for 1974 suggest intercensal trends in labour force participation which, in the case of females, move in completely different directions. Considering the poor state of factual evidence about the issue, there are probably as many good arguments to explain an increase of females labour force participation as there are to explain the opposite. However, one of the alternatives must be wrong—and so must be the particular census release that supports it.

Age and sex structure, literacy and labour force are the main substantive topics in the Census publications released prior to the *National Volume*. In addition, one table in *Bulletin No. 2* gives the number of households enumerated in each subdivision of the preliminary household count of 1973. All the publication efforts, which were considerable, consisted in detailing this information at various geographic levels, sometimes distinguishing between rural and urban areas.

Work on small geographic levels or on rural/urban differentials is sensitive to both the extent and the biases of underenumeration—a point the census users' attention should have been kept focused on. Since the census had missed nearly every fifth urban dweller—according to the Census Commission's own estimates—it seems rather pointless, or perhaps even unfair to have run a publication programme that made misuse of the data almost inevitable ; even more so when the crucial underenumeration estimates were mentioned quite casually in a 7 line paragraph in the introductory notes to

[2]The *1979 Statistical Yearbook of Bangladesh* [5] quoted literacy data from the *National Volume*, while the *Monthly Statistical Bulletin of Bangladesh* [4] quoted *Bulletin No. 2*.

TABLE IV

COMPARISON OF LABOUR FORCE FIGURES : BULLETIN NO. 2 AND NATIONAL VOLUME

(A) MALES

Districts	Total Labour Force		Total Employed		Working in Agriculture		Looking for Work		%Difference Nat Vol.-Bull. 2*			
	Bull.2	Nat. Vol.	Bull.2	Nat. Vol.	Bull 2.	Nat. Vol.	Bull.2	Nat. Vol.	Total Labour Force	Total Employed	Working in Agr.	Looking for Work
CHI	1,141,498	1,263,682	1,036,307	1,191,309	498,315	698,111	105,191	72,373	10.7	15.0	40.1	—31.2
CHT	158,021	166,542	154,936	164,563	99,055	135,574	3,085	1,979	5.4	6.2	36.9	—35.9
COM	1,480,436	1,551,887	1,396,352	1,496 500	992,562	1,237,969	84,084	55 387	4.8	7.2	24.7	—34.1
NOA	765,166	824,980	701,178	779,467	486,190	627,173	63,988	45,513	7.8	11.2	29.0	—28.9
SYL	1,341,437	1,380,742	1,287,361	1,357,569	955,098	1,182,531	54,076	23,173	2.9	5.5	23.8	—57.1
DAC	2,054,690	2,209,965	1,949,984	2,141,577	926,398	1,119,506	104,706	68,388	6.7	9.8	20.8	—34.7
FAR	1,014,584	1,097,277	984,597	1,080,980	754,336	942,756	29,987	16,297	8.2	9.8	25.0	—45.7
MYM	2,108,688	2,162,079	2,068,686	2,135,470	1,627,115	1,904,695	40,002	26,609	2.5	3.2	17.1	—33.5
TAN	503,265	545,230	486,993	534,503	372,086	456,988	16,272	10,727	8.3	9.8	22.8	—34.1
BAK	982,862	1,037,226	943,047	1,012,537	638,103	798,935	39,815	24,689	5.5	7.4	25.2	—38.0
JES	822,037	847,217	801,578	833,413	597,563	707,666	20,459	13,804	3.1	4.0	18.4	—32.5
KHU	868,966	976,347	836,466	948,037	554,524	662,500	32 500	28,310	12.4	13.3	19.5	—12.9
KUS	478,980	493,366	470,400	486,095	330,440	387,504	8,580	7,271	3.0	3.3	17.3	—15.3
PAT	366,156	398 854	351,265	392,043	266,999	345,673	14,891	6,811	8.9	11.6	29.5	—54.3
BOG	580,762	598,336	566,647	587,791	459,271	525,364	14,115	10,545	3.0	2.1	14.4	—25.3
DIN	700,070	725,237	685,785	718,056	580,371	640,146	14,285	7,181	3.6	4.7	10.3	—49.7
PAB	710,233	748,013	688,538	734,430	467,081	555,876	21,695	13,583	5.3	6.7	19.0	—37.4
RAJ	1,034,273	1,106,329	1,012,883	1,094,279	789,155	951,987	21,390	12,050	—7.0	8.0	20.6	—43.7
RAN	1,628,240	1,517,288	1,570,995	1,490,724	1,316,939	1,348,121	57,245	26,546	—5.8	—5.1	2.4	—53.6
Bangladesh	18,740,364	19,650,597	17,993,998	19,179,343	12,711,601	15,229,075	746,366	471,254	4.9	6.6	19.8	—36.9

*% in relation to *Bulletin 2* figures.

(Contd.)

TABLE IV (*Contd.*)

(B) FEMALES

Districts	Total Labour Force		Total Employed		Working in Agriculture		Looking for Work		Difference Nat. Vol.—Bull. 2*			
	Bull.2	Nat.Vol.	Bull.2	Nat. Vol.	Bull.2	Nat.Vol	Bull.2	Nat. Vol.	Total Labour Force	Total Employed	Working in Agri.	Looking for Work
CHI	402,696	56.032	389,003	53,278	44,840	28,584	13,693	2,754	—86.1	—86.3	—36.3	—79.9
CHT	110,315	57,001	108,457	56,695	45,226	54,607	1,858	406	—48.3	—47.8	+20.7	—78.1
COM	649,492	107.643	638,561	104.787	181,529	92,920	10,931	2,856	—83.4	—83.6	—48.8	—73.9
NOA	144.000	23.362	140.190	22,468	16,619	17,218	3,810	894	—83.8	—84.0	+3.6	—76.5
SYL	425,127	75.168	405,088	71.239	68,827	55,282	20,039	3.929	—82.3	—82.4	—19.7	—80.4
DAC	558,104	100,741	538,405	96,471	87,587	42,782	19 699	4,270	—81.9	—82.1	—51.2	—78.3
FAR	331,861	26,945	326,932	25,964	43,647	19,369	4,929	981	—91.9	—92.1	—55.6	—80.1
MYM	704,937	75,929	697,883	74,172	168,840	57,905	7,054	1.757	—89.2	—89.4	—65.7	—75.1
TAN	166,125	12,469	163,132	11,994	36,852	6,944	2,993	475	—92.5	—92.6	—81.2	—84.1
BAR	398,289	29.130	390,064	26,531	39,526	15,833	8,225	2,599	—92.7	—93.2	—59.9	—68.4
JES	252,231	18.299	249,579	17,608	35,540	12,158	2,652	691	—92.7	—92.9	—65.8	—73.9
KHU	168,294	33,158	163,767	30,890	12,137	15,725	4,527	2,268	—80.3	—81.1	+29.6	—49.9
HUS	39,369	11.966	38,696	11,656	1,316	4,493	673	310	—69.6	—69.9	+241.4	—53.9
PAT	144,394	15,840	141,506	15,396	17,252	8.633	2.888	444	—89.0	—89.1	—50.0	—84.6
BOG	215,635	23.080	212,784	21,539	59,967	16.969	2,851	1,541	—89.3	—89.9	—71.7	—45.9
DIN	216,786	58,631	214,601	58,162	61,794	51,450	2,185	469	—73.0	—72.0	—16.7	—78.5
PAB	248,760	24,258	243,684	22,921	52,553	10,393	5,076	1,337	—90.2	—90.6	—80.2	—73.7
RAJ	445.233	62,757	441 051	61,080	116,404	62,068	4,182	1,677	—85.9	—86.2	—46.7	—59.9
RAN	819,316	59,586	806,363	57,792	158,686	45,475	12.953	1,794	—92.7	—92.8	—71.3	—86.1
Bangladesh	6,440,964	871.995	6,309,746	840,543	1,249,142	618,808	131,218	31,452	—86.5	—86.7	—50.5	—76.0

*% in relation to *Bulletin*. 2 figures

Sources : [6, Tables 7 and 8 ; 3 Tables 14 and 15].

TABLE V

ACTIVITY RATES IN 1961 AND IN 1974 (TWO VERSIONS)

		1961 Census	1974 Bull.2	1974I Nat. Vo.
Crude Activity Rate	Males	56.2	50.6	53.0
(labour force /total population)	Females	10.8	18.7	2.5
Crude Agricultural Activity Rate	Males	45.5	34.3	41.1
(agri. labour force/total pop)	Females	9.6	3.6	1.8
Net Activity Rate	Males	87.6	77.6	80.4
(labour force/pop. aged 10 &+	Females	17.4	29.7	4.0
Net Agricultural Activity Rate	Males	71.0	52.7	62.3
(agric. labour force/population aged 10 &+	Females	15.4	5.8	2.8

Sources : [3, p. 34] ; [6, Tables 7 and 8].

Bulletin No. 2. It is thus not surprising that also trained statisticians, like those of the Bangladesh Bureau of Statistics, eventually came to fall into embarrassing traps in their attempts to utilise the census data.[3]

III. THE QUANTIFICATION OF DEMOGRAPHIC DYNAMICS

In the previous section we reviewed a number of discrepancies between figures published in different releases of the 1974 Census. The conflict between tally-sheet based data and *National Volume* data is worth being highlighted if nothing else because it reveals unsolved problems of management of the Census operation, which the user of the data will be well advised not to overlook. However, since those discrepancies were involuntary, no substantive issues of accuracy or relevance of the data are involved. It is these issues we shall now try to examine, bearing in mind that one of the charac-

[3]Although underenumeration rates were mentioned, the issue of differential underenumeration and its implications for the analysis of the census results was never raised. Perhaps as a result of this neglect, one can find corrected and uncorrected census population figures, standing side by side in the 1979 Bangladesh Statistical Yearbook. Such inconsistencies are particularly striking and damaging for trend analysis because 1961 data are always uncorrected. When these are combined with 1974 data corrected for underenumeration, the resulting intercensal population growth rate is obviously unreasonable.

teristics of the statistical situation in Bangladesh is precisely the lack of a corpus of alternative evidence which one could use as standard to decide on the quality of a particular census figure in objective terms. Nation-wide data are not only scarce but also difficult to compare because of differences in methodology and scope ; as a result, a judgement on the quality of the census data will often have to be based on common sense and conventional wisdom, tools which at times can hardly be worth more in terms of robustness than the figures under review.

Census completeness : population size, population growth and urban/rural distribution issues

The 1974 Census (like the previous one, of 1961) tried to assess empirically its own completeness by carrying out a post-enumeration check.[4] Ideally, this would provide not only an esitmate of the extent of omissions, but also help to identify possible underenumeration biases in respect to characteristics like sex, age, place of residence and socio-economic status.

PEC operations in Bangladesh have so far been unsuccessful. In 1961, the PEC was so much less exhaustive than the census that it actually suggested the census had overcounted the population by 1.6%. Nothing so obviously discouraging happened in 1974—although merely by chance, one would be tempted to say. First, field reverification intervened very late, in October and November 1974, more than six months after census enumeration. Secondly, the PEC excluded the floating population—persons with no fixed address. Thirdly and most important of all, the matching operations "ran into difficulties" as the Census report mildly put it. Census records could be found for only 119 out of the 482 original sample blocks, leaving completely unrepresented 14 out of 66 census districts. As a result, the sophisticated PEC sampling scheme lost its relevance and the PEC was finally completed on 59 census blocks, 48 rural and 11 urban (drawn from the city areas of Dacca, Chittagong, Khulna and Narayanganj).

Understandably enough, the "full report" on the PEC survey—which *Bulletin No. 2* promised would form part of the final Census report never saw the light. As the Census Commission itself repeatedly admitted thereafter, the results of the PEC were "of limited value", not only as conceded because the number of blocks was too small, but also and more decisively

[4]A post-enumeration check (PEC) consists in reenumeration of the individuals in an adequate sample of census blocks, matching these records with the census records and, in case of discrepancies, returning to the field to establish the reality of the data.

indeed, because the collection of blocks which were finally retained could hardly be considered as "sample". In particular, the fact that all of the 11 urban blocks were drawn from city areas poses a problem to census users concerned with fine regional planning or urban growth : how to correct the population figures for underenumeration in the urban non-city areas ? Should one assume that the rate of underenumeration attributed to the rural areas (6.5%) also applies to the smaller towns, or should one on the contrary assume that all urban areas suffered from the same incidence of omission (19.3%) detected in the PEC city blocks ? Which policy did the Census Commission adopt to calculate the much quoted revised population figure of 76.4 million ?[5] These issues were never raised in the Census publications : in fact, concern with the methodology of the PEC went only as far as to provoke a remark on the "limited value of the PEC results"—but no further than that.

One might be tempted to argue that, given the weakness of the whole PEC operation, wondering whether a particular raising factor should apply or not byond the boundaries of certain *pourashavas* appears as an excessively fastidious endeavour. The Census Commission, as it happens, chose to interpret the PEC rates of underenumeration in the way which minimised the overall number of omissions—by applying the high "urban" raising factor of 1. 193 to the *pourashava* areas of the 4 cities in the "sample". All other metropolitan and urban populations were corrected using the "rural' factor of 1.065. A less restrictive use of the "urban" rate of undercount would have raised the revised total population figures by about half a million. The point in case is not, however, which particular raising factor is preferable—it is rather the lack of methodological restraint in the use of PEC figures, once it became clear that the post-enumeration check had been a failure. In this connection, one may note that while both the 1961 and 1974 PECs can be considered as totally unsuccessful operations, the 1974 PEC had a more pernicious influence on the ulterior course of research. The 1961 PEC discredited itself very obviously by suggesting that the Census had been affected by overcount rather than by undercount of the population. This forced census users to work out alternative estimates, based on explicit assumptions about the extent and the patterns of differential underenumeration.[6] Although this type of work is seldom very conclusive in terms of scientific achievement, it is a sound reminder of the poor quality of the census data base. In 1974, the PEC

[5]Also the results of the PEC were differently reported in *Bulletin No. 2* and the *National Volume*. In the former source, rates of underenumeration stood at 6% and 16% for rural and urban areas respectively.

[6]See for instance, Krotki [10] and Bean, Khan and Rukanuddin [2].

results pointed at least in the right direction and they were thus superficially more credible. The apparent objectivity of the post-enumeration set-up tended to conceal the need for independent estimates based on researched guess-work. Repeated quotation then created the conditions for a consensus, to which the revised population figure of 76.4 million entirely owes its notoriety.

Breaking up this consensus is not an easy task because alrernative indirect estimates have to be based on chains of assumptions whose subjective character is highly discomforting. All figures involved—be it the rate of undercount in the previous census, the levels of the intercensal birth, death and net migration rates or the parameters of the age and sex structure—are largely open to question. For instance, revised estimates of total population for 1961 vary between 53.4 million (Bean, Khan and Rukanuddin) and 55.2 million (Krotki), while the enumerated figure stood at 50.8 million. Even if a consensus could be reached on the magnitude of the intercensal growth rate, these differences of opinion about the size of the population in 1961 would make room for large and increasing variation in the estimate of total population in subsequent years : a growth rate of 2.8% per annum would in this case yield estimates varying from 73.0 million to 79.2 million as of March 1, 1974.[7]

As it is, these uncertainties are compounded by the lack of consensus about the actual rate of poupulation growth. As far as birth and death rates are concerned, there is a relative abundance of estimates, mostly based on analytical work rather than on direct observation. However, to illustrate the precariousness of the available statistical evidence, one may mention two facts : firstly, even marginal discrepancies in estimates of annual growth rate will produce considerable differences in the projected population total at the end of the intercensal period. For instance, a difference of 1 per thousand between estimates of annual growth rate for the period 1961-74 will produce a variation of about 1 million in the resulting estimates of total population in 1974—which also means a variation of more than one percentage point in the assessment of the census rate of underenumeration. Secondly, the discrepancies between estimates of growth rate are in fact any-

[7]Note that the choice of a particular revised total population figure for 1961 entails an implicit judgement on the comparative performance of the 1961 and 1974 censuses. The 1974 Census report endorses Krotki's estimates, which imply a rate of underenumeration of 8.6% in 1961. Since the PEC indicated an overall rate of undercount of 6.9% in 1974, one could feel inclined to think that at least a small progress in census completeness had been achieved. On the contrary, Bean, Khan and Rukanuddin's estimate would imply a rate of underenumeration of 5.1% in 1961—and consequently a deteriorating level of performance of the census operations.

thing but marginal : one single schedule of age specific fertility rates (viz., for instance, the Bangladesh Retrospective Survey of Fertility and Mortality), when applied alternatively to a few of the age and sex structure estimates available for 1974, will yield birth rates varying from 45 to 50 per thousand. If, in addition, different fertility schedules were considered, the range of variation among the resulting birth rate estimates would be even greater. Similar observations also apply to death rates. Finally, there is the issue of external migration, on which no data worth speaking of is available. The censuses do provide a few hints about Hindu outmigration—the Hindu population seems to have increased by a mere 3% between 1961 and 1974, in contrast with a 49% increase for Muslims—but migration of Muslims from Bangladesh to neighbouring Indian states also came into focus during recent communal unrest about the issue of "foreign settlers" in Assam and Tripura.

In the light of these considerations it seems pointless to envisage using alternative statistical sources to assess the completeness of the census. Once again, the important point is not as much to settle for a particular estimate of growth rate, as it is to understand the practical meaning and the limits of any such figure. During the last intercensal period, several disasters (the Indo-Pakistan war of 1965, the 1970 cyclone and the War of Liberation in 1971—72) in addition to taking their toll in terms of forced migration and extra deaths also disrupted social conditions, with the likely effect of depressing fertility. As a consequence, even if both the 1961 and the 1974 censuses had been accurate enough to enable us to compute the actual growth rate experienced during that period, the result of this exercise would be largely circumstantial and inadequate to describe the growth momentum that might have manifested itself under "normal" conditions ; in other words, it would lack predictive value—and should therefore not be used for population projection exercises, unless one is making specific assumptions about future "Malthusian" checks on population growth similar to those experienced between 1961 and 1974.

This point seems to have been overlooked by the Bangladesh Bureau of Statistics together with various other agencies which in their population projections have been using the 2.5% annual growth rate (derived from the PEC and Krotki's revised population estimates) as a benchmark growth rate for the period 1970-75.[8] Apart from the fact that using Bean, Khan and Rukanuddin's estimate intstead of Krotki's would have yielded an intercensal growth rate closer to 2.8%—one may note the contradiction between implicit and explicit assumptions on the future course of population. While at

[8]See, for instance, [5, p. 66].

the explicit level one is assuming that a decline of mortality will take place, at the implicit level one operates in fact with levels of growth which reflect unusually large catastrophies. The possibility that pressure to produce more "palatable" population projections might have prompted the statisticians and planners to take census evidence for its face value, confers a certain political dimension to the issue of census defectiveness. If census users are willing to be misled—if and when this might be expedient—then there is little scope for improvement of the census, because of the lack of functional incentive to progress towards this end.

However, as far as these issues are concerned, we still are in a comparatively fortunate situation, since there is at least some alternative evidence, no matter how scanty, which can be contrasted with census based data. Regarding other issues—particularly in the areas of urbanisation and internal migration—the situation is more discouraging. On the one hand, the results of the PEC strongly suggest that census performance was poorer in the urban areas—although the contention that as much as one fifth of the population had been omitted is supported by extremely frail evidence drawn from a few city census blocks. Whatever the actual rates of omission and how these may be extrapolated to the urban non-city areas—for which there is no PEC evidence—the urban/rural differential in Census completensss casts serious doubts upon any assessment of the process of urbanisation, the magnitude and the characteristics of rural-urban migration and, generally speaking, the comparative position of rural and urban areas in respect to their demographic and socio-economic characteristics. On the other hand, unlike for the natural components of growth, Census evidence on the urban-rural population distribution is the only evidence available : it cannot be contrasted with any alternative figures at all. Finally, insofar as comparisons with 1961 are necessary to establish the dynamics of the urban-rural interactions and differentials, research is radically hampered by the absence of data on differential incompleteness at the previous census.

Age and Sex Structure

The analysis of the defectiveness of Census data on age and sex deserves particular emphasis, because these characteristics are the backbone not only of demographic analysis as such but also of most applications of the demographic approach to specific planning and policy making tasks. But defectiveness of the data *per se* is too academic a problem to retain the attention of a non-specialised audience. What really matters is the inferences that the data elicit or can be used to support, concerning substantive matters of

general socio-economic research and policy making concern—like fertility, mortality, migration, assessment of socio-demographic resources and socio-demographic induced needs.

To illustrate this point, one can for instance consider the issue of the sex ratio in Bangladesh. According to the 1974 Census, it stood at 108 males per hundred females. Confronted with this particular figure, the census user might either take it for its face value—and interpret the excess of males as a sign of female overmortality—or discard it on the assumption that it barely reflects census undercount of women.

Since the implications of either stance are entirely different, one can hardly be satisfied with the teachings of conventional wisdom, which as far as the sex ratio issue in Bangladesh is concerned, can only sugest that there is probably both female overmortality and female underenumeration. On the one hand, it is possible that census enumerators —all of them male and census respondents – practically always a male member of the household—both will have a strong tendency to omit females, perhaps particularly the unmarried girls. Although this hypothesis has never been empirically tested, it has been propounded often enough to undermine one's confidence on the credibility of the recorded sex ratios. On the other hand, while there is some fragmentary evidence of female overmortality (for instance, in the data originated by the Matlab surveillance system), also supported by numerous sociological observations on women's unequal access to food and health care—a closer look at the Census age specific sex ratios reveals nevertheless patterns erratic enough to discourage any attempt to assign a definite mortality pattern to such data. In 1974, sex ratios were low among children up to 10 years and among young adults aged 20 to 35 – that is, through a large proportion of females' reproductive life (Table VI). Between ages 10 and 20, and after 35, sex ratios abruptly rise to very high values. Although on the whole the dispersion of the age specific sex ratio distribution has been somewhat reduced in comparison to 1961—which is rather felicitous—changes have not always occurred in what would seem to be the most sensible direction. All this implies patterns, levels and trends of differential mortality which are clearly outside the range of plausible demographic phenomena.[9]

[9]For instance, a fall of the sex ratio from a presumable level of 106 at birth to 100 at the first anniversary would imply an unlikely large extent of male overmortality, the magnitude of which is an inverse function of the estimated level of the infant mortality rate (IMR). Assuming that the IMR for both sexes stands at 150 per thousand, the resulting sex specific levels of infant mortality would be 184 per thousand for males and 125 for females—i.e., a rate of male overmortality of about 40%. Although male overmortality itself is a biologically plausible feature, it is technically doubtful that, at the present levels of exogenous

(*contd*).

Obviously, one has to exert a considerable degree of violence on the empirical data to make them yield some presentable estimate of mortality. However, as if only to worsen the state of confusion prevailing in these matters, the Bangladesh Retrospective Survey of Fertility and Mortality which was also carried out by the Bangladesh Bureau of Statistics, produced life-tables revealing male overmortality. In BBS publications one can thus find population projections which are based on the assumption of female overmortality and, almost side by side, life tables which show just the opposite.[10]

TABLE VI

AGE SPECIFIC SEX RATIOS (1974 AND 1961 CENSUS) . .

Age	Sex Ratios 1974			Sex Ratios 1961		
	All Areas	Rural	Urban	All Areas	Rural	Urban
0	100	100	99	100	100	102
1	100	99	105	95	95	99
2	98	98	100	97	97	102
3	98	98	100	96	96	98
4	102	101	103	101	101	102
1—4	99	99	102	97	97	100
5—9	101	101	102	104	105	102
0—14	119	120	110	128	128	131
5—19	114	113	123	97	94	153
0—24	97	91	153	92	87	195
5—29	94	88	158	100	97	175
0—34	100	96	158	110	106	177
5—39	114	110	171	124	121	202
0—44	115	111	172	113	110	171
5—49	126	122	179	127	124	186
0—54	116	113	169	118	116	167
5—59	135	132	175	140	139	180
0 &+	130	129	139	123	123	133
ll Ages	108	106	129	108	106	142

Sources : [3, Table 4] ; 1961 Census Vol. 2, Tables 13 and 15.

ontd.)

nfant mortality in Bangladesh, male's biological handicap could play such a radical role in etermining their chances of survival in comparison to females. Moreover, statistics from e Matlab surveillance system show that male overmortality during the first year of life as generally been well under 10%, at the comparatively low levels of infant mortality bserved in Matlab.

[10]See for instance, [4, Tables 1.5 and 1,17].

Mortality is just one of the many substantive issues at stake in sex ratio analysis ; hadn't it been for the unreliability of the census, one could contemplate to use sex ratios as indirect evidence or the study of migration, nuptiality, etc. However, the type of dilemmas that emerge in the course of research is characteristically illustrated by the Census Commission comment on the observed decline of the urban sex ratio from 142 in 1961 to129 in 1974 : "This fact would tend to indicate better coverage of urban women in the 1974 Census than in 1961, though greater female migration to cities to join their husbands working there cannot be excluded" [3, p. 9].

Again, the implications of either interpretation are of course radically different. "Females joining their working husbands" would imply profound changes in the pattern of rural outmigration, indirectly pointing at a transformation of the socio-economic and cultural status of rural women ; it would also mean that new quantitative and qualitative demands for housing, education and employment are emerging in the urban areas. "Better coverage", on the contrary, would mean that any of the above inferences are erroneous interpretations of a statistical artifact. The conciliatory stance of conventional wisdom,which would view the trends in the sex ratio as partly substantive and partly artificial, leaves our dilemma intact : any measure of improvement of census coverage reduces the substantive content of the observed trends ; but if coverage has remained severely defective, the observed trends are significant only to the extent that they are not biased by the errors of observation.

Sex ratios by marital status raise the same type of dilemma in the area of nuptiality. The ratio between married men and married women stands at 99. While this figure can be positively interpreted as an indication that the enumeration of married women was failrly exhaustive—at least when their husbands had been enumerated—it makes little room for outmigration of married males leaving behind their wives and for whatever extent of polygamy still might exist in Bangladesh society.[11] Yet, a more disturbing result is the sex ratio among the never-married, which stands at 132 single males per 100 single females in the total population—and even reaches a dramatic 219 single males per 100 single females when children under 10 years of age are excluded. Part of this imbalance can be explained by girls being married off at much lower ages than boys—the difference in singluate Mean Age at Marriage (SMAM) being at present about 8 years. But it is also highly plausible that census respondents tend to omit mentioning the existence of unmarried females living in the household. The Bangladesh Fertility Survey, which was in all probability

[11] Data from Matlab show that about 5% of all marriages involve currently married bridegrooms.

conducted in a more inquisitive manner than the Census, yielded a substantially lower sex ratio among the never-married aged 10 years and over : 186 males per hundred females.[12]

Although it is convenient to treat the issues of female undercount and age misreporting under the same heading—because these issues often emerge together in the course of population structure analysis—they are in fact problems of different nature. Underenumeration of certain population categories is basically a problem of slack management of the census operation—although by no means a trivial matter. The roots of age misreporting are more deep-seated : in the socio-cultural and administrative setting of Bangladesh, chronological age by reference to a date of birth is simply a bureaucratic oddity. Most people do not know their date of birth and even if they did, in the absence of vital registration records, there would be little point anyway in sticking to it to reckon one's age. As it is, the advantages of this flexibility are rather obvious in most bureaucratic contexts. In everyday life, age is important—and extremely important indeed—only in defining relative positions of seniority/juniority ; but even in such strictly comparative contexts, perceptions of age are largely determined by one's rank in a scale of conventional life-cycle sequences—rather than by chronological considerations. For women, marriage and motherhood seem to be significant determining factors in the perception of age. Apart from the considerations of self-interest in the underreporting of age of prospective brides because of the stigma associated with prolonged celibacy—the fact that marriages are traditionally arranged successively according to the rank of seniority among the siblings invites to a perception of age which legitimates the actual marital state of the person concerned. After marriage, the "seniority" of status conferred by child-bearing tends to push upwards the perceived chronological age.

The problem faced by analyst in using such data is compounded by the fact that one lacks empirical evidence about the biases in age reporting. Only such evidence could enable the analyst to make substantiated judge-

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[12]The thorny aspect of this question lies with the relationship between selective underenumeration of single females on the one hand, and sex ratio imbalances and SMAM estimates on the other. Actual increases in female age at marriage will improve the balance of the sex ratio between single males and single females ; but a greater visibility of unmarried females would also result in higher estimates of the SMAM even if in fact no changes in the marriage patterns did really occur. Although we do not intend to challenge the opinion that age at marriage has been slowly rising during the last few decades, we think that possible differentials in coverage of unmarried females might explain why in Bangladesh surveys tend to yield higher SMAM estimates than the Censuses. The obvious implication is that chronological series, consisting of both Census and survey data based SMAM estimates at different points of time, might suggest trends which, either did not actually take place or, at least, did not assume the observed magnitude.

ments and measure the risks entailed by the acceptance of any particular figure. In fact, the only instances of empirical research on age misreporting in Bangladesh are creditable to sources other than the Census, namely the Population Growth Estimation Experiment (PGE) of 1962-65 and the 1975 Bangladesh Fertility Survey.[13] Judging from the nature of most discussions on age data in the literature, it seems that the devastating evidence generated on this issue by the PGE has by and large passed completely unnoticed. It might be useful to recall it here.

The data (Table VII) concerns a sample of women interviewed in the first quarter of 1962 and again in the first quarter of 1965 that is, at a 3-year interval. Their reported ages were subsequently matched, and the resulting distribution of the individual age differences shows that, at best, only half of the women gave answers to both surveys somewhat in line with the actual process of chronological ageing. In the age-group 30-39, about one third of the women reported ages which, in 1965, were either unchanged or lower in relation to 1962. In the age-group 40 and over, also about one third of the women reported ages which yield a difference of more than 10 years—in a substantial proportion of cases, more than 15 years—over a 3-year chronological period.

The BFS post survey check (Table VIII) extended the analysis of age misreporting to the age of the respondent's children. The results are quite stunning, considering the fact that less than six month had elapsed between the main survey and the re-interview, and that a survey of this type provided an exceptionally favourable framework for the collection of demographic data—at any rate a framework of much better quality than the average census interview.

TABLE VII

DIFFERENCES IN AGES REPORTED BY WOMEN INTERVIEWED IN 1962 AND REINTERVIEWED 3 YEARS LATER

Age Group	Age in 1965 Less than in 1962					No. Difference	Age in 1965 More than in 1962					Total
	15&+	10–14	6–9	4–5	1–3		1–3	4–5	6–9	10–14	15&+	
15-19	0.5	0.7	2.4	3.5	10.3	0.9	30.5	19.3	16.3	6.5	1.2	100
30-39	1.1	2.6	3.8	6.2	8.0	11.0	16.1	15.1	14.4	14.6	7.2	100
40&+	0.2	1.3	1.7	4.0	8.7	9.7	14.2	15.6	13.9	16.1	14.7	100
All Women :	0.6	1.5	2.7	4.6	9.1	9.8	22.5	17.2	15.2	11.1	5.8	100

Sources : [9, p. 110].

[13] See also Ahmed [1].

Although this sort of evidence does not enable us to "correct" empirical age distributions—because we still do not know in fact how the individuals' true age is positioned in relation to the range of answers they give at different interviews—it nevertheless highlights the degree of cultural alienation that is built in the statisticians' attempts to collect data on chronological age from people who, for various reasons, do not and possibly could not see the point in operating with such a concept.

Should we then completely discard census age data—or, even more radically—renounce to collect data on chronological age ? Posed in explicit terms, these questions are likely to sound highly heretical. In implicit terms, however, census age data—or for that matter, any empirically observed age data—have always been so severely corrected when there was need for a pre-

TABLE VIII

DIFFERENCES IN AGES REPORTED AT BFS MAIN SURVEY (DECEMBER 1975) AND BFS POST SURVEY CHECK (MAY 1976)

(a) Current Age of the Respondent

Age at P.S.C. Less than at M.S.					No Difference	Age at P.S.C. More than at M.S.				
5 years and+	4 years	3years	2 years	1 year		1 year	2years	3 years	4 years	5 years and+
4.4%	2.3%	5.8%	11.6%	16.0%	23.0%	14.0%	7.3%	6.1%	2.9%	6.7%

(b) Age of the Eldest Child

Age at P.S.C. Less than at M.S.					No.Difference	Age at P.S.C. More than at M.S.				
5 years and+	4 years	3years	2 years	1 year		1 year	2years	3years	4 years	5years and+
6.0%	1.6%	3.5%	6.6%	16.1%	31.5%	20.8%	7.9%	1.9%	1.3%	2.8%

(c) Age of the Youngest Child

Age at P.S.C. Less than at M.S.					No. Difference	Age at P.S.C. more than at M.S.				
5 years and+	4years	3 years	2 years	1 year		1 year	2 years	3 years	4 years	5 years and
2.8%	1.3%	0.9%	6.0%	9.5%	48.9%	18.9%	7.3%	1.9%	0.6%	1.9%

Source : [11, pp. 100—101].

sentable age pyramid that, in fact, the process of correction amounts very much to a recognition that observed data hardly make any sense at all.

Table IX shows four different estimates of the age and sex structure of the population in 1974—two empirical exercises, with their corresponding analytically corrected versions. The fact that very substantial discrepancies exist between observed and corrected figures is in itself rather trivial—although it might be illuminating to consider the magnitude of these discrepancies for a few critical segments of the age distribution—for instance, children below age 1, children aged 5 to 9 or women aged 15 to 24. Also the gap between observed and corrected figures is very substantial—as expected. A more disquieting feature is however the fact that the differences between corrected structures—which reflect divergences of scientific opinion are only marginally smaller than the differences between observed structures—which only reflect the vagaries of data collection.

TABLE IX

AGE AND SEX STRUCTURE 1974; EXERCISES IN OBSERVATION AND ESTIMATION

(Population figures in 000's ; percentages of total population)

A) MALES

Age	Observed Data				BRSFM	Corrected Data				Version 2/
	Census	%	BRSFM	%	Census	Version 1	%	Version 2	%	Version 1
0	941	1.3	905	1.3	96	1.641	2.1	1,739	2.3	106
1—4	5,074	7.1	4,447	6.2	88	5,458	7.1	5,718	7.5	105
5—9	6,600	9.2	6,185	8.7	94	5,769	7.5	58,20	7.6	101
10—14	4,987	7.0	5,348	7.5	707	4,918	6.4	4,730	6.2	96
15—19	3,154	4.4	3,323	4.7	105	4,184	5.5	4,017	5.3	96
20—24	2,416	3.4	2,648	3.7	110	3,534	4.6	3,362	4.4	95
25—29	2,353	3.3	2,577	3.6	110	2,962	3.9	2,891	3.8	98
30—34	2,036	2.8	2,101	2.9	103	2,473	3.2	2,391	3.1	97
35—39	2,035	2.8	2,072	2.9	102	2,051	2.7	1,983	2.6	97
40—44	1,745	2.4	1,724	2.4	99	1,684	2.2	1,635	2.1	97
45—49	1,379	1.9	1,368	1.9	99	1,360	1.8	1,343	1.8	99
50—54	1.284	1.8	1,216	1.7	95	1,081	1.4	1,066	1.4	99
55—59	776	1.1	794	1.1	102	828	1.1	858	1.1	104
60—64	919	1.3	877	1.2	95	611	0.7	658	0.9	108
65—69	430	0.6	439	0.6	102			487	0.6	
70—74	489	0.7	469	0.6	96	883	1.2	339	0.4	139
75&+	455	0.6	456	0.6	100			399	0.5	
All Ages	37,071	51.9	36,948	51.8	100	39,437	51.6	39,437	51.6	100
Selected Age Groups										
0—4	6,014	8.4	5,352	7.5	89	7,099	9.3	7,457	9.8	105
5—14	11,586	16.2	11,533	16.2	100	10,687	14.0	10,550	13.8	99
0—14	17,600	24.6	16,885	23.7	96	17,786	23.3	18,007	23.6	101
15—49	15,118	21.1	15,813	22.2	105	18,248	23.9	17,622	23.1	97
15—64	18.097	25.3	18,700	26.2	103	20,768	27.2	20,204	26.4	97
65 &+	1.373	1.9	1,364	1.9	99	883	1.2	1,225	1.6	139

(Contd.)

B) FEMALES

(Table IX Contd.)

Age	OBSERVED DATA				BRSFM/	CORRECTED DATA				Version 2/
	Census	%	BRSFM	%	Census	Version 1	%	Version 2	%	Version 1
0	945	1.3	904	1.3	96	1,571	2.1	1,664	2.2	106
1—4	5,112	7.1	4,586	6.4	90	5,175	6.8	5,528	7.2	107
5—9	6,519	9.1	6,200	8.7	95	5,422	7.1	5,625	7.4	104
10—14	4,194	5.9	4,675	6.6	111	4,594	6.0	4,533	5.9	99
15—19	2,765	3.9	3,014	4.2	109	3,892	5.1	3,777	4.9	97
20—24	2,496	3.5	2,653	3.7	106	3,271	4.3	3,101	4.1	95
25—29	2,512	3.5	2,607	3.7	104	2,735	3.6	2,636	3.5	96
30—34	2,027	2.8	2,016	2.8	99	2,273	3.0	2,161	2.8	95
35—39	1,780	2.5	1,772	2.5	100	1,881	2.5	1,793	2.3	95
40—44	1,514	2.1	1,479	2.1	98	1,545	2.0	1,484	1.9	96
45—49	1,097	1.5	1,135	1.6	103	1,264	1.6	1,222	1.6	97
50—54	1,105	1.5	1,049	1.5	95	1 016	1.3	974	1.3	96
55—59	576	0.8	607	0.9	105	798	0.9	784	1.0	98
60—64	763	1.1	697	1.0	91	603	0.7	601	0.8	100
65—69	305	0.4	325	0.5	107			440	0.6	
70—74	365	0.5	329	0.5	90	921	1.2	304	0.4	117
75+	331	0.5	315	0.4	95			334	0.4	
All Ages	34,407	48.1	34,365	48.2	100	36,961	48.4	36,961	48.4	100
Selected Age Groups										
0—4	6 058	8.5	5 490	7.7	91	6,746	8.8	7,192	9.4	107
5—14	10 713	14.0	10 875	15.2	102	10,016	13.1	10,158	13.3	101
0—14	16 771	23.5	16 365	22.9	98	16,762	21.9	17,350	22.7	104
15—49	14 191	19.8	14 676	20.6	103	16,861	22.1	16,174	21.2	96
15—64	16 635	23.3	17 029	23.9	102	19,278	25.2	18,533	24.3	96
65&+	1 001	1.4	969	1.4	97	921	1.2	1,078	1.4	117

(Table IX Contd.)

(c) BOTH SEXES

Age	OBSERVED DATA				BRSFM/	CORRECTED DATA				Version 2/
	Census	%	BRSFM	%	Census	Version 1	%	Version 2	%	Version 1
0	1,886	2.6	1,809	2.6	96	3,212	4.2	3,403	4.5	106
1—4	10,186	14.2	9,033	12.6	8 9	10,633	13.9	11,246	14.7	106
5—9	13,118	18.3	12,385	17.4	94	11,191	14.6	11,445	15.0	102
10—14	9,181	12.8	10,023	14.1	109	9,512	12.4	9,263	12.1	97
15—19	5,918	8.3	6,337	8.9	107	8,076	10.6	7,794	10.2	96
20—24	4,912	6.9	5,301	7.4	108	6,805	8.9	6,463	8.5	95
25—29	4.866	6.8	5,184	7.3	106	5,697	7.5	5,527	7.3	97
30—34	4,063	5.7	4,117	5.7	101	4,746	6.2	4,552	6.0	96
35—39	3,814	5.3	3,844	5.4	101	3,932	5.1	3.776	4.9	96
40—44	3,258	4.6	3,203	4.5	98	3,229	4.2	3,119	4.0	97
45—49	2,477	3.5	2,503	3.5	101	2,624	3.4	2,565	3.4	98
50—54	2,389	3.3	2,265	3.2	95	2,097	2.7	2,040	2.7	97
55—59	1,352	1.9	1,401	2.0	104	1,626	2.1	1.642	2.1	101
60—64	1,683	2.3	1.574	2.2	93	1,214	1.6	1,259	1.7	104
65—69	735	1.0	764	1.1	104			927	1.2	
70—74	854	1.2	798	1.1	93	1,804	2.4	643	0.8	128
75 & +	786	1.1	771	1.0	98			733	0.9	
All Ages	71.478	100	71.313	100	100	76,398	100	76,398	100	100
Selected Age Groups										
0—4	12,073	16.9	10.842	15.2	90	13,845	18.1	14,649	19.2	106
5—14	22,299	31.2	22.408	31.4	100	20,703	27.1	20,708	27.1	100
0—14	34,372	48.1	33.250	46.6	97	34,548	45.2	35,357	46.3	102
15—49	29.308	41.0	30.489	42.8	104	35,109	46.0	33,796	44.3	96
15—64	34,732	48.6	35.729	50.1	103	40,046	52.4	38 737	50.7	97
65& +	2,375	3.3	2,333	3.3	98	1,804	2.4	2,303	3.0	128

Sources : Census observed data : [3. Table 4] and [7, p. 247].
Corrected data : Version 1 : [12, pp. 31-32]; Version 2 : [7, p. 50].

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Note

Uniqueness of Ranking Given by Various Measures of Capital Intensity

by

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The issue of the choice of technology is being debated for more than two decades. The growing unemployment in the less developed countries and an increasing concern in these countries for the absorption of unemployed labour has renewed interest in the question of technological choice. Despite the importance of the problem, a generally accepted definition or indicator of capital intensity is yet to be found. Various statistical measures of capital intensity have been suggested and used in the economic literature. Among the most widely used are : (i) the capital-value added ratio(K/V), (ii) value added per employee (V L), and (iii) the capital-labour ratio (K/L).

Although one single measure is used in most cases, it should be pointed out that the various indicators are in no way mutually exclusive. Rather, conclusions based on any one of them can be used in conjunction with those derived from the use of the other(s). This becomes all the more important when one notes that while the first two of the indicators mentioned above represent efficiency in the use of inputs, efficiency considerations are left out of account by the third measure (K/L). It is thus apparent that the ranking of industries or techniques based on capital-labour ratio may diverge from that based on either the capital coefficient or value added per employee. And yet, these three measures are often interchangeably used in the literature. It is, therefore, important to derive the conditions under which the ranking based on the capital coefficient or value added per employee will be the same as that

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given by the capital-labour ratio. The purpose of this note is to derive these conditions. This is done by exploring some qualitative relationships between (a) capital-labour and capital-value added ratios, and (b) capital-labour ratio and value added per employee.

Capital-Labour and Capital-Value Added Ratios

It can be shown that if profit and wage rates are uniform, the ranking given by the capital-value added ratio must be the same as that given by capial labour ratios.

Using the following notations

π=profit rate, V=value added, K=capital,

L=labour and W=wage rate,

We can write

$$\pi=(V-Lw)/K \quad \cdots(1)$$

Now we have, for two industries denoted by subscripts 1 and 2,

$$\pi_1=(V/K)_1-(L/K)_1\ W_1 \quad \cdots(2a)$$

$$\pi_2=(V/K)_2-(L/K)_2\ W_2 \quad \cdots(2b)$$

Consider the following cases.

Case I : $\pi_1=\pi_2$, and $W_1=W_2$

In this case it is clear that $(L/K)_1>(L/K)_2$ implies $(V/K)_1>(V/K)_2$. Thus, with uniform wage and profit rates, a higher capital-labour ratio in one industry must also imply higher capital-value added ratio in that industry.

If, however, wage and profit rates are not uniform in the two industries, no such definite conclusion can be drawn. Now, we consider the case where profit rates are uniform but wage rates are not.

Case II : $\pi_1=\pi_2$, but $W_1\neq W_2$

In this case, we have, from (2a) and 2b),

$$(V/K)_1-(V/K)_2=(L/K)_1\ W_1-(L/K)_2\ W_2$$

or, $$(V/K)_2\left[\frac{(V/K)_1}{(V/K)_2}-1\right]=(L/K)_2\ W_2\left[\frac{(L/K)_1\ W_1}{(L/K)_2\ W_2}-1\right] \quad \cdots(3)$$

It is to be noted that $(L/K)_1$, $(L/K)_2$, W_1, $W_2>0$.

Now, we want to see what is implied about the relationship between $(V/K)_1$ and $(V/K)_2$ by $(L/K)_1>(L/K)_2$.

Case IIa : $W_1>W_2$

Since $[(L/K)_1/(L/K)_2]>1$, and $(W_1/W_2)>1$, clearly, the RHS of (3) is greater than zero.

$\therefore$ LHS>0

$\therefore$ $[(V/K)_1/(V/K)_2]>0$, i.e., $(V/K)_1>(V/K)_2$

Thus in this case also, higher capital-labour ratio implies higher capital-value added ratio.

Case IIb : $W_1<W_2$

It is clear from (3) that in this case, the RHS can be equal to, greater, or less than zero. Hence, no definite conclusion can be drawn about the relative size of $(K/V)_1$ and $(K/V)_2$.

Case III : $W_1=W_2$, but $\pi_1\neq\pi_2$

In this case, we have, from (2a) and (2b),

$$[(V/K)_1-\pi_1]/(L/K)_1=[(V/K)_2-\pi_2]/(L/K)_2$$

or $(L/K)_1/(L/K)_2=[(V/K)_1-\pi_1]/[(V/K)_2-\pi_2]$ ...(4)

Now, we consider the relative size of $(V/K)_1$ and $(V/K)_2$ when $(L/K)_1>(L/K)_2$

From (4) we have,

$$(V/K)_1-\pi_1>(V/K)_2-\pi_2$$

$$\therefore\ (V/K)_1-(V/K)_2>\pi_1-\pi_2$$

Case IIIa : $\pi_1>\pi_2$

In this case, it is clear that

$$(V/K)_1-(V/K)_2>0$$

$$\therefore\ (V/K)_1>(V/K)_2$$

Thus, the rankings given by the capital-value added and capital-labour ratios are same even if profit rates are non-uniform, provided that wage rates are uniform and $\pi_1 > \pi_2$ for any two industries.

Case IIIb :

Here again, we cannot draw any definite conclusion about the relative size of $(V/K)_1$ and $(V/K)_2$.

Thus we see that in the cases II and III, where we have considered non-uniform wage and profit rates, there can be an asymmetry in the rankings given by capital-labour and capital-value added ratios.

Capital-Labour Ratio and Value Added per Employee

The relationship between these two measures can also be seen from equation (1). Here again, we can show that if profit and wage rates are uniform, the rankings given by these two measures must be the same. From (1), we can write.

$$\pi = (V/K) - (L/K) \cdot W$$

$$\text{or,} \quad \pi = (L/K)\,[(V/L) - W] \qquad \cdots (5)$$

For two industries denoted by subscripts 1 and 2, we have

$$\pi_1 = (L/K)_1 \; [(V/L)_1 - W_1] \qquad \cdots (6a)$$

$$\pi_2 = (L/K)_2 \; [(V/L)_2 - W_2] \qquad \cdots (6b)$$

Now, consider the following cases

Case I : $\pi_1 = \pi_2$, $W_1 = W_2$:

In this case, $(V/L)_1 > (V/L)_2$ must imply $(L/K)_1 < (L/K)_2$, i.e., $(K/L)_1 > (K/L)_2$.

Again, if profit and wage rates are not uniform, no such definite conclusion can be drawn. This is shown below :

Case II : $\pi_1 = \pi_2$, but $W_1 \neq W_2$

From (6a) and (6b), we have

$$(L/K)_1 \; [(V/L)_1 - W_1] = (L/K)_2 \; [(V/L)_2 - W_2]$$

$$\text{or} \quad [(V/L)_1 - W_1)] / \; [(V/L)_2 - W_2] = (L/K)_2 \,/\, (L/K)_1 \qquad \cdots (7)$$

Now, we want to consider the implications for $(V/L)_1$ and $(V/L)_2$ when $(L/K)_2 > (L/K)_1$ i.e., $(K/L)_1 > (K/L)_2$.

From (7), we have

$$(V/L)_1 - W_1 > (V/L)_2 - W_2$$

or $(V/L)_1 - (V/L)_2 > W_1 - W_2$

<u>Case IIa : $W_1 > W_2$</u>

In this case it is clear that $(V/L)_1 - (V/L)_2 > O$.

Hence, $(V/L)_1 > (V/L)_2$.

<u>Case IIb : $W_1 < W_2$</u>

Here, we cannot draw any qualitative conclusion regarding the relative size of $(V/L)_1$ and $(V/L)_2$.

<u>Case III : $W_1 = W_2$, but $\pi_1 \neq \pi_2$</u>

From (1), we have

$$W_1 = (V/L)_1 - \pi_1 / (L/K)_1$$

$$W_2 = (V/L)_2 - \pi_2 / (L/K)_2$$

$$\therefore\ (V/L)_1 - \pi_1 / (L/K)_1 = (V/L)_2 - \pi_2 / (L/K)_2$$

or, $(V/L)_1 - (V/L)_2 = \pi_1 / (L/K)_1 - \pi_2 / (L/K)_2$

$$\text{or } (V/L)_1 - (V/L)_2 = \pi_2 / (L/K)_2 \left[\frac{(L/K)_2\ \pi_1}{(L/K)_1 .\ \pi_2} - 1 \right] \qquad \cdots (8)$$

Now, if $\pi_1, \pi_2 > 0$, and $(L/K)_2 > (L/K)_1$, we have the following results.

<u>Case IIIa : $\pi_1 > \pi_2$</u>

In this case the right hand side of (8) is positive.

Hence,

$$(V/L)_1 - (V/L)_2 > 0$$

$$\therefore\ (V/L)_1 > (V/L)_2.$$

Thus, higher capital-labour ratio implies higher value-added per employee.

Case IIIb : $\pi_1 < \pi_2$

Here again, RHS $\lessgtr 0$. Hence, no definite conclusion can be drawn about the relative size of $(V/L)_1$ and $(V/L)_2$.

Conclusion :

Thus we see that with uniform wage and profit rates the rankings given by the three measures under discussion will be the same. If on the other hand, wage and profit rates are not uniform, the ranking given by the capital-value added ratio or value added per employee may be different from that given by the capital-labour ratio.

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An Econometric Model Simulation of the World Jute Market

by

MUSTAFA K. MUJERI*

This paper is concerned with the empirical analysis of the international market for raw jute and jute manufactures. A dynamic disaggregated model is developed and estimated, and found satisfactory. The model is then used in simulation experiments to assess the impact, on both producing and consuming regions, of possible international agreements regarding the price of jute. It has been found that such agreements would typically have only limited benefits for the producing nations, as a result of the high and increasing elasticity of substitution between jute and synthetic substitutes.

I. INTRODUCTION

This paper presents an annual model of the post-Second World War jute[1] market. The model is developed in order to analyze the long-run structural aspects of the jute market in terms of the dynamic inter-relationships between jute production, consumption, inventory accumulation, and prices. There are a number of aspects of the world jute market that make it an interesting subject for analysis. Although government influence or participation in jute production and marketing occurs in varying degrees in some of the major producing countries, the international price of raw jute (and hence, of jute manufactures) is determined essentially by the interaction of the forces of demand and supply. Since jute is predominantly a product of subsistence agriculture in a few developing countries and the largest consumers are the major developed countries of the world, a very high percentage of the world production of jute enters international trade either in the raw or processed form. Moreover, it is an important source of foreign exchange for the principal producing countries of Bangladesh, India, and Thailand. In the case of Bangladesh, for example, jute is by far the most important commodity exported and manufactured, accounting for about 80 per cent of the total proceeds of all merchandise exports in recent years. The great importance of raw jute to the major consumers is due to

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*The author teaches in the Department of Economics, Rajshahi University. The paper is based on the Ph. D. dissertation of the author [18]. He wishes to express his indebtedness to Professors B.G. Spencer, F.T. Denton, and R.A. Muller for their help and encouragement in the study. They are, of course, excluded from the responsibility for any errors that remain.

[1]The term 'jute' has been used throughout the paper to include other allied fibres, e.g., kenaf, roselle, etc. which are close substitutes for jute.

the fact that the cost of raw materials constitutes an unusually high proportion of the gross product of these industries.

In the case of jute no comprehensive model of the market has been available. Instead the market has been analyzed on the basis of fairly simple models with forecasts generated basically by trend extrapolations with assumed values of the parameters. Though such methods have the advantages of simplicity and computational speed they might often be misleading due to failure to capture the inherent characteristics of the market.[2] In this paper an attempt has been made to specify and estimate the most important structural relationships in the world jute market, incorporating both the raw jute and jute manufacturing sectors. Particular emphasis is given to the distributed-lag nature of any of these relationships ; in this respect, the study owes much to the pioneering work of Nerlove on agricultural markets.[3] The resulting model is then utilized for conditional nonstochastic forecasts.

The paper is organized as follows. A brief survey of the relevant institutional, technological, and historical aspects of the world jute market are described in Section II. In Section III, an annual model of the post-war world jute market is developed and analyzed. The complete model, including the definitional identities, is brought together in Section IV, and simulations are carried out over the 1961-73 sample period and forecasts are generated for the 1974-90 period. Moreover, several policy simulations over the two periods are conducted to analyze the impacts of different hypothetical international raw jute agreements for stabilization of prices. Finally, Section V concludes the paper.

II. A BRIEF SURVEY OF THE WORLD JUTE MARKET

Jute is second only to cotton in its importance as a vegetable fibre and, together with kenaf and roselle, has long been of major importance in many parts of the tropics and the subtropics as a cash crop and as raw material for agro-industries. Jute is used in the manufacture of a wide variety of products with applications in industry, agriculture, transport, and the household. Its end-uses may be conveniently classified into four major groups : sacking, carpet backing, hessian, and a fourth miscellaneous group consisting mainly of cordage and felting. Trends in the world production, consumption and exports, for both raw jute and jute manufactures, for the major countries are shown in Table I. It is significant that at least 70 per cent

2Since the surge of commodity prices in 1973/74 and the demand by the Third World countries for the creation of a "New International Economic Order", econometric models of commodity markets have recently emerged as an effective new approach in this field for better understanding of the principal world markets for agricultural products and their analysis. For a discussion of the state of the art in commodity model building, see Labys [16] and the references cited there.

3See, for example, Nerlove [19].

TABLE I

WORLD PRODUCTION, CONSUMPTION, AND EXPORTS OF RAW JUTE (INCLUDING ALLIED FIBRES) AND ITS MANUFACTURES

(In thousand metric tons)

Country or Region	RAW JUTE						JUTE MANUFACTURES					
	Production[b]			Exports[b]			Production[a]			Consumption		
	1949-52 Average	1960-61	1974-75	1951-56 Average	1961-66 Average	1974-75	1955-58 Average	1961-65 Average	1975	1953-55 Average	1961-63 Average	1974
Bangladesh	948	1050	726	931	749	279	147	306	445	—	—	—
India	670	927	1047	—	18	72	1076	1200	990	182	350	460
Thailand	11	187	360	1	203	161	—	—	146	—	—	—
U.S.A.	—	—	—	—	—	—	—	—	—	303	430	372
E.E.C.	—	—	—	—	—	—	537	468	142	243	264	257
Other Countries	200	494	1638	12	12	67	—	—	—	1447	1971	3041
TOTAL :	1829	2658	3771	944	982	581	1760	1974	1798	2175	3015	4130

[a] Total of countries shown only.

[b] For Bangladesh and India, July-June season. For other countries, calendar year of first year shown.

Sources : FAO, *Commodity Review and Outlook,* various issues and *Production Yearbooks,* different issues.

of total jute production enters international trade either in the raw or processed form. Morever, the outstanding features in the development of world jute consumption since the Second World War have been the reduced level of consumption in most of the economically advanced countries in North America and Western Europe and the expansion in consumption in the rest of the world. This is mainly due to competition from other materials, especially the synthetic substitutes, in virtually all the end-uses of jute in the developed countries. The polyolefin plastics, mainly high density polyethylene and polypropylene which are by-products of the petro-chemical industry, has already captured a major share of the jute maket in these countries.[4] Several factors have accounted for this phenomenal market development of polypropylene in direct competition with jute : relative prices, market structure, product performance and development, and marketing techniques. Since 1960, the production of polypropylene increased at the high rate of over 50 per cent per year and the resulting economies of scale, technological improvements, and competition among producers have brought its prices down at a rapid rate. During the same period, the price of jute has fluctuated around a rising trend. However, the increase in the price of crude oil and embargoes and production cuts during 1973 by the OPEC countries resulted in steep rises in the prices of the synthetics throughout the world. Despite these increases, however, the available estimates suggest that the consumption of the synthetics in the traditional jute markets will increase in the future.[5] It appears that such an increase would not only practically eliminate any possible scope for growth of the jute market in these countries, but threatens as well to reduce further the existing market unless the producing countries are able to maintain competitive price levels for jute coupled with other policy measures to ensure regular and uninterrupted supply.

III. A MODEL OF THE WORLD JUTE MARKET

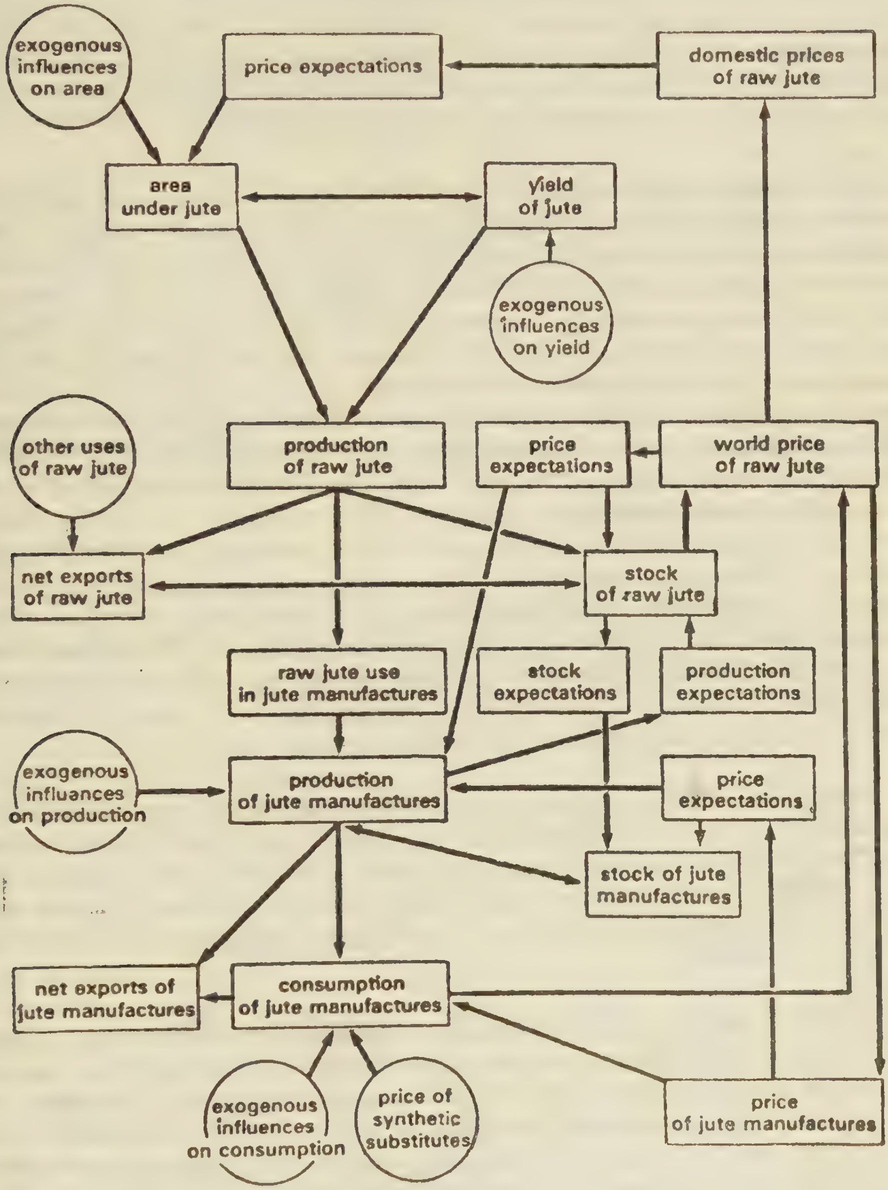
In this section we shall consider the construction of an annual model of the world market for jute for the post-Second World War years. The model will encompass the main aggregative flows in the jute market. Flow chart 1 shows a schematic diagram of the world jute model indicating the way in which the major industry variables are related to one another. One interesting feature of the model is the explicit analysis of both raw jute and jute manufactures as separate products. Moreover, in analyzing the markets, the interactions between the two products have been considered. In the following paragraphs the important relationships of the model are summarized.

In explaining the production of raw jute, the area under jute cultivation has been used as a proxy for planned production since the yield of raw jute is influenced mainly

[4]For details of competition between jute and synthetics, see [8 ; 13].

[5]See [13 ; 14].

SCHEMATIC DIAGRAM OF THE WORLD JUTE MODEL



Flow Chart—1

by random factors (e.g., weather), due, in part, to the subsistence nature of cultivation. It is hypothesized that the actual area under cultivation, rather than actual production, is a much better index of planned production. The area under jute is influenced, among other factors, by the expectations of jute prices in relation to the price of alternative crops by the growers. Based on such hypotheses, acreage equations for jute are estimated for Bangladesh, India, and Thailand. Yield of jute equations, along with the acreage equations, provide the production of raw jute.

The producing nations utilize raw jute for three main purposes—exports, production of jute manufactures, and carry-over stocks. In the model, production of jute manufactures and carry-over stocks are estimated while net exports have been determined residually after allowing for other exogeneous uses of raw jute. The production of jute manufactures by the seven countries/regions in the model—Bangladesh, India, U.K., U.S.A., Japan, EEC countries, and the "Rest-of-the-World" sector—are hypothesized mainly to be influenced by the expectations of prices of raw jute and jute manufactures and, in some cases, by a time trend variable. The carry-over stocks of raw jute—estimated for the three major producing countries of Bangladesh, India, and Thailand—are assumed to be determined by future price and production expectations, along with other variables. As in the case of raw jute, net exports of jute manufactures are determined residually after allowing for domestic consumption and stocks. Except in the cases of Bangladesh and India where the consumption of jute manufactures has been estimated directly, the total consumption of jute manufactures plus synthetic substitutes has been estimated first and then the allocation between the two has been determined for the five other countries/regions. The stocks of jute manufactures equations for India and Bangladesh, the two major producing nations, are estimated.

Finally, the world price of raw jute equation is estimated ; the price is hypothesized to be influenced by world stocks of raw jute and world consumption of raw jute. The world price of jute manufactures is dependent upon the world price of raw jute. Finally, the domestic prices of raw jute and jute manufactures are linked with the world prices of raw jute and jute manufactures respectively, for the major producing countries.

In total the model consists of 39 stochastic equations and 25 identities. Except for the jute acreage equations, which can be estimated by ordinary least squares, the model is estimated by the method of two-stage least squares. However, the use of some form of instrumental variables for the first stage is necessitated by the dimensions of the model. In this study we have used a method due to Fair, along with variables chosen by the method suggested by Fisher, which describes the estimation of consistent parameters in the presence of lagged endogenous variables and first-order serially correlated errors.[6]

[6]See [6 ; 11].

In determining the final forms of the equations for the complete world model, there was a certain amount of experimentation with different forms of each equation. Because of the size of the model, the whole model was not re-estimated for each form of each equation. However, when the final specification of the model was determined, all equations in the model were re-estimated and it is these estimates that are reported. The relationships of the model are expressed, in so far as is possible, in terms of comparable real economic variables. Most of the necessary data have been collected from the annual publication of the Commonwealth Economic Committee, *Industrial Fibres* and the *Production and Trade Yearbooks* of the Food and Agricultural Organization of the United Nations. These have been checked, whenever possible, with the national publications of different countries to maintain the greatest possible level of accuaracy.

Model Specification

The model of the world jute market is presented here in brief while the empirical estimation of the model are presented in the following section. Variable definitions are presented in Appendix A.

The Supply of Raw Jute

The model contains equations explaining the production of raw jute in the three major producing countries—Bangladesh, India, and Thailand—as well as in the "Rest-of-the-World" sector. Since the collective price response of the jute growers manifests itself primarily in the form of acreage response, area under jute has been used in this study as a proxy for planned production, which is the relevant variable for supply responsiveness. Most of the world's jute is produced within the predominantly rice-growing areas of Bangladesh and India where for most farmers the cultivation of jute is primarily a choice between a cash crop and the staple food crop. The jute/rice price ratio has long been recognized as a key determinant of the area under jute vis-a-vis rice.[7] In addition to prices of jute and rice, the choice of other non-price explanatory variables is a difficult task. It seems impossible to use all potential relevant variables in estimating acreage functions of jute, due to data limitations and multicollinearity and other associated problems. Nevertheless, based on *a priori* information, the desired acreage eequation is specified as :

$$ACR_t^* = \alpha_0 + \alpha_1 P_t^* + \alpha_2 \text{ RYPA}_t^* + \alpha_3 \text{ SDRAV}_t + \alpha_4 \text{ FAPOP}_t + \alpha_5 T + U_t \quad \ldots \; (1)$$

The expected price variable, P_t^*, has been used both in the form of a ratio between the prices of jute and rice and separately. For simplicity, and given the subsistence nature of cultivation, the relative yield rate of the previous season has been taken as the expected yield rate ($\text{RYPA}_t^* = \text{RYPA}_{t-1}$). The SDRAV_t variable

[7]See, for example [5 ; 7].

has been added as a proxy for the variance of the subjective probability distribution of the subsistence farmers of their risk-aversion behaviour. The time trend, T, and the farm population, $FAPOP_t$, have been included to account for other technological and institutional changes and the effect of population increase on jute acreage respectively. In order to build into the jute acreage equations the essential dynamic aspect that the area cannot be changed instantly in response to changing economic conditions, the adjustment lag may be specified as:

$$ACR_t - ACR_{t-1} = \lambda \left[ACR_t^* - ACR_{t-1} \right], \; 0 < \lambda \leq 1 \qquad \dots (2)$$

where λ is the "coefficient of adjustment". From (1) and (2) the following equation can be obtained, if it is assumed that $P_t^* = P_{t-1}$:

$$ACR_t = \alpha_0\lambda + \alpha_1 \lambda P_{t-1} + (1-\lambda) ACR_{t-1} + \alpha_2 \lambda RYPA_{t-1} + \alpha_3 \lambda SDRAV_t + \alpha_4\lambda FAPOP_t + \alpha_5 \lambda T + V_t \qquad \dots (3)$$

In the case of Bangladesh, a dummy variable, DUM, is introduced for the year 1971 for war and FAPOP variable was dropped due to its statistical insignificance. For Thailand, the equation was estimated with only price, relative yield, and time trend variables.

In order to arrive at the production of jute figures for the three countries involved in our model, it is necessary to estimate the yield per acre of jute equations which, along with the estimated jute acreage equations, will provide the production of jute in the respective countries. The yield rate of jute, which is predominantly cultivated under subsistence agriculture, is mostly determined by random factors such as weather, rainfall, and the like. These environmental factors, although very relevant in yield equations, are difficult to quantify due to their very nature and non-availability of reliable data. Under the circumstances, the actual yield per acre of jute is defined to be a linear function of the following form:

$$YPAJ_t = a_0 + a_1 ACR_t + a_2 T + a_3 T^2 + U_t \qquad \dots (4)$$

The price of jute compared to alternative crops was also used but did not produce any significant coefficient. A dummy variable was added for Bangladesh and India for 1960 when much of the crop was damaged by extensive flood and disease.

In order to complete the production side of raw jute, a study of production of raw jute in the 'Rest-of-the-World" sector was undertaken. A Nerlovian lagged adjustment model is used with lagged production and a time trend variable as explanatory variables. A price variable was also included; however, it did not perform well and so was not included in the final equation.

Production of Jute Manufactures

In this section, models are described to explain the production of jute manufactures in the major producing countries—India, Bangladesh, U.K., U.S.A., Japan, EEC countries and in a "Rest-of-the-World" sector. While the production of jute manufactures in India and Bangladesh is mainly for exports, production in most other countries is geared to domestic consumption.

The decision to produce jute manufactures is closely related to the volume of sales by the jute mills. The model used to explain the desired or equlibrium level of production of jute manufactures at period t, $PRODJM_t^*$, is :

$$PRODJM_t^* = \alpha_0 + \alpha_1 \left[\frac{PJM}{PRJ}\right]_t + \alpha_2 \left[\frac{PJM}{PRJ}\right]_{t+1}^e + \alpha_3 T + \alpha_4 SJM_{t-1} \quad \text{... (5)}$$

The explanatory variables are the current and future expected price ratios between the domestic prices of jute manufactures and raw jute, a time trend variable, and the last period's stocks of jute manufactures. The ratio of the two prices of the final output and the raw material has been added as a proxy for the profitability of the production decision. As for the expected relative price, we use the model of 'extrapolative" expectations, in which

$$\left[\frac{PJM}{PRJ}\right]_{t+1}^e = \left[\frac{PJM}{PRJ}\right]_t + \beta\triangle \left[\frac{PJM}{PRJ}\right]_t , \quad -1<\beta<1 \quad \text{... (6)}$$

and the dynamic adjustment equation

$$PRODJM_t - PRODJM_{t-1} = \delta\,[\,PRODJM_t^* - PRODJM_{t-1}\,] \quad \text{... (7)}$$

would yield the following estimating equation :

$$PRODJM_t = \delta\alpha_0 + (1 - \delta)\,PRODJM_{t-1} + \delta(\alpha_1 + \alpha_2) \left[\frac{PJM}{PRJ}\right]_t + \delta\alpha_2\beta\triangle \left[\frac{PJM}{PRJ}\right]_t + \delta\alpha_3 T + \delta\alpha_4 SJM_{t-1} \quad \text{... (8)}$$

Equation (8), although it performed quite satisfactorily for Bangladesh, India and "Rest-of-the-World" sector, was proven unsatisfactory for the other countries in the model. When experimentation with some other variables were also found unsatisfactory it was decided to regress production against time in the dynamic adjustment framework. Specifically,

$$PRODJM_t = \alpha_0 + \alpha_1\, PRODJM_{t-1} + \alpha_2\, TIME \quad \text{... (9)}$$

A dummy variable was added for 1960 when floods in India and Bangladesh caused a world-wide shortage of the fibre which affected the levels of production of these countries. The unsatisfactory specification of these equations is not expected to affect the world model much since the production of jute manufactures in these four countries constitutes a small percentage of total world production (for example, during 1974 the total production in these four countries constituted only about 7 per cent of total world production).

Consumption of Jute Manufactures

As was the case for the supply equations, the distinction between "short-run" and "long-run" or "equilibrium" relationships is important in studying the demand for a commodity. In order to introduce this distinction a dynamic flow-adjustment model is utilized in which the demand for jute manufactures depends on underlying economic factors (such as income), and the effects of these factors are spread out over time. The adjustment process is represented as:

$$CONJM_t - CONJM_{t-1} = \delta[CONJM_t^* - CONJM_{t-1}] \qquad \ldots (10)$$

where δ measures the speed of adjustment of actual to desired consumption. The equilibrium net consumption demand is specified as :

$$CONJM_t^* = \alpha_0 + \alpha_1 PJM_t + \alpha_2 NI_t + \alpha_3 \frac{NI_t}{NI_{t-1}} \qquad \ldots (11)$$

All price and income variables are deflated to get the equation in "real" terms. The NI_t/NI_{t-1} variable is included to test the relationship to consumption, of the growth of income from recent levels. From (10) and (11) the following equation, suitable for estimation, is obtained :

$$CONJM_t = \delta\alpha_0 + (1-\delta)\, CONJM_{t-1} + \delta\alpha_1\, PJM_t + \delta\alpha_2 NI_t + \delta\alpha_3 \frac{NI_t}{NI_{t-1}} \qquad \ldots (12)$$

Since there are no theoretical considerations dictating a specific functional form, equation (12) was estimated in both linear and log-linear forms for Bangladesh and India. In both cases, the log-linear form gave decidedly better results and hence this particular form was chosen to represent the consumption demand equations for Bangladesh and India.

For the other five countries/regions in the model, equations are estimated for total current consumption demand for jute manufactures and synthetic substitutes that compete with jute manufactures and subsequently the current consumption demand for jute manufactures relative to synthetic substitutes is estimated in a

separate relationship. In this case also, based on a dynamic-flow-adjustment model, the adjustment processs is presented as :

$$CONJS_t - CONJS_{t-1} = \delta[\, CONJS_t^* - CONJS_{t-1} \,] \qquad \dots (13)$$

The equilibrium level of consumption, $CONJS_t^*$, is hypothesized to depend on national income (or change in national income) and time trend variable :

$$CONJS_t^* = \alpha_0 + \alpha_1 \, NI_t + \alpha_2 T \qquad \dots (14)$$

The "real" weighted price of jute manufactures and synthetic substitutes was also included in some cases in an attempt to represent the effects of this price on marginal costs and thus on movements along the final demand curves. From equation (13) and (14) , the following estimating equation can be obtained :

$$CONJS_t = \delta\alpha_0 + (1\text{-}\delta)\, CONJS_{t-1} + \delta\alpha_1 \, NI_t + \delta\alpha_2 T \qquad \dots (15)$$

In order to determine the relative shares of jute manufactures and synthetic substitutes, the relationships, if any, of the relative prices and the market shares of the two products are investigated. These relationships are of interest to producers of both jute manufactures and synthetic substitutes. This is also of general interest, as a case study of marginal productivity analysis and of substitution between factors of producton. There is no doubt that technological factors rather than economic factors dominated the process of the jute market's adjustment to synthetic substitutes. Unfortunately, due to lack of data, we are unable to construct any index of the technical change associated with the industry. However, it is hoped that the price of the substitutes would reflect the effects of technological change within the industry.

The industry, using jute manufactures and/or synthetic substitutes as their inputs to produce the final consumption goods, is assumed to be competitive. All firms in the industry are assumed to have CES production functions, with differing multiplicative "efficiency parameters."[8] The production function for the i^{th} firm can be represented as

$$0_i = S^i \left[\left\{ \left(\alpha_0 J_1^{-k} + J_2^{-k} \right)^{-1/k} \right\}^{-\lambda} + \left\{ \left(\alpha_1 K^{-s} + L^{-s} \right)^{-1/s} \right\}^{-\lambda} \right] - \frac{f(0_i)}{\lambda} \qquad \dots (16)$$

where J_1 refers to jute manufactures, J_2 is synthetics, K and L stand for capital and labour respectively, and α_0, α_1 k, s, and λ are parameters.

Since the production function satisfies the conditions of homothetic separability[9] and under the assumption of exogeneity of the jute manufactures and synthetic

8The well-known constant-elasticity-of-substitution productlon function [3].

9See [2 ; 4 ; 20].

price ratio, we can write the ratio of inputs of jute manufactures to synthetics as functions solely of their price ratios. In general, the marginal productivity conditions are recursive. In its reduced form the model can be written as

$$\frac{J_1}{J_2} = \alpha_0{}^{\sigma}\left[\frac{PJM}{PSS}\right]^{-\sigma} U_0 \qquad \ldots (17)$$

where $\sigma = 1/k + 1$.

Equation (17) was estimated in the log-linear form, made familiar by Arrow *et al.* [3] :

$$\ln\frac{J_1}{J_2} = \sigma\ln\alpha_0 - \sigma\ln\frac{PJM}{PSS} + \ln U_0 \qquad \ldots (18)$$

Due to unavailability of data, the list price of polypropylene in the United States is used for all data cells which would not be misleading since price trends in other countries has been very similar to that in U.S.A.

Demand for Stocks of Raw Jute

The "producer stocks" of raw jute are assumed to be held in the three major producing countries—Bangladesh, India, and Thailand. The non-availability of reliable data is the deciding factor for assuming that the consuming countries do not hold any stocks. The simple model used in this study to explain the desired or equilibrium level of carry-over stocks of raw jute, SRJ_t^*, is

$$SRJ_t^* = \alpha_0 + \alpha_1\, PRJW_t + \alpha_2\, PRJW^e_{t+1} + \alpha_3 RJUJM_t + \alpha_4 RJUJM^e_{t+1} + \alpha_5 DEVNP_t \qquad \ldots (19)$$

For the future expected variables, using the "extrapolative expectations";

$$PRJW^e_{t+1} = PRJW_t + \beta \triangle PRJW_t \;, -1 < \beta < 1 \qquad \ldots (20)$$

$$RJUJM^e_{t+1} = RJUJM_t + \gamma \triangle RJUJM_t \;, -1 < \gamma < 1 \qquad \ldots (21)$$

and using the flexible accelerator concept suggested by Goodwin [12]

$$SRJ_t - SRJ_{t-1} = \delta[SRJ_t^* - SRJ_{t-1}],\; 0 < \delta \leq 1 \qquad \ldots (22)$$

the following equation can be obtained :

$$SRJ_t = \delta\alpha_0 + (1-\delta)\; SRJ_{t-1} + \delta(\alpha_1 + \alpha_2)\; PRJW_t + \delta\alpha_2\beta \triangle PRJW_t + \delta(\alpha_3 + \alpha_4)\; RJUJM_t + \delta\alpha_4\gamma \triangle RJUJM_t + \delta\alpha_5\; DEVNP_t \qquad \ldots (23)$$

Specification (23) is in terms of observed variables and can be estimated.

Demand for Stocks of Jute Manufactures

Stocks of Jute manufactures are held in both the producing and consuming nations presumably to facilitate transactions and meet unexpected emergencies. However due to data limitations the (approximately true) assumption is made that the stocks are held in only the two most important producing countries—Bangladesh and India. The model used to explain the desired or equilibrium stocks SJM_t^*, is :

$$SJM_t^* = \alpha_0 + \alpha_1 PRODJM_t + \alpha_2 PRODJM^e_{t+1} + \alpha_3 SRJ^e_{t+1} \qquad \dots (24)$$

As in the case of raw jute stocks based on the extrapolative expectations behaviour the expected variables can be written as:

$$PRODJM^e_{t+1} = PRODJM_t + \beta \triangle PRODJM_t \;, -1<\beta<1 \qquad \dots (25)$$

$$SRJ^e_{t+1} = SRJ_t + \gamma \triangle SRJ_t \;, -1<\gamma<1 \qquad \dots (26)$$

Moreover it is assumed that the holders can adjust actual stock to desired stock by only a fraction, δ, in any one year due to errors in calculations and other rigidities :

$$SJM_t - SJM_{t-1} = \delta[SJM_t^* - SJM_{t-1}], \;\; 0<\delta\leq 1 \qquad \dots (27)$$

From the above equations the following equation can be obtained :

$$SJM_t = \delta\alpha_0 + (1-\delta)\, SJM_{t-1} + \delta(\alpha_1+\alpha_2)\, PRODJM_t + \delta\alpha_2\beta \triangle PRODJM_t + \delta\alpha_3 SRJ_t + \delta\alpha_3\gamma \triangle SRJ_t \qquad \dots (28)$$

Prices of Raw Jute and Jute Manufactures

In this section equations are specified for the estimation of the world prices of raw jute and jute manufactures and attempts are made to relate the world prices to the domestic prices in the producing countries. Because of the importance of the London market in the world jute economy, the London prices of raw jute and jute manufactures have been treated as world prices and all other prices of raw jute and jute manufactures used in the study are related to the London prices.

The world price of raw jute is hypothesized to be a linear function of (a) the current world stock of raw jute relative to the current world consumption of raw jute (b) a time trend variable to account for the long term secular trend in jute prices

and (c) a dummy variable to represent large speculative price increased in the world jute market during the outbreak of the Korean War in 1950 :

$$PFJW_t = \alpha_0 + \alpha_1 \frac{WSRJ_t}{WCRJ_t} + \alpha_2 T + \alpha_3 \text{KOREA} + U_0 \qquad \ldots (29)$$

The domestic prices or more specifically the prices received by farmers of raw jute are related to the world price through the following equation :

$$\ln PRJ_t = \ln \alpha_0 + \alpha_1 \ln (PRJW_t - EXDT_t - FR_t) + \alpha_2 \ln ER_t \qquad \ldots (30)$$

Dummy variables were added for Bangladesh for Korean War of 1950-53 and independence war of 1971 for India and Thailand for 1971.

The price of jute manufactures is closely related to the price of raw jute. It is hypothesized to be a linear function of price of raw jute along with dummy variables for Korean War of 1950-53 and India-Pakistan wars of 1965 and 1971 :

$$PJMW_t = \alpha_0 + \alpha_1 PRJW_t + \alpha_2 \text{KOREA} + \alpha_3 \text{DUM} + U_0 \qquad \ldots (31)$$

Finally the domestic prices of jute manufactures which were used in the production of jute manufactures equations for Bangladesh and India are related to the world price of jute manufactures in terms of the following equation :

$$\ln PJM_t = \ln \alpha_0 + \alpha_1 \ln(PJMW_t - EXDT_t - FR_t) + \alpha_2 \ln ER_t \qquad \ldots (32)$$

A dummy variable was added for both equations for the India-Pakistan wars of 1965 and 1971.

The results of estimation are summarized in the following section.

IV. EMPIRICAL ESTIMATION OF THE MODEL AND SIMULATIONS

Equations (1) through (50) are the final forms of the jute production, stocks, price and consumption equations in the world jute market model. The variable definitions are given in Appendix A. The estimated t-ratios of all coefficients are given beneath the coefficients and the estimated values of the multiple correlation coefficients (corrected for degrees of freedom) $\bar{R}^2$, the Durbin-Watson statistic, DW and the first order autoregression coefficient, ρ, estimated by the Cochrane-Orcutt iterative procedure whenever found necessary are also reported for each estimated equation.

The statistical properties of the estimated equations vary quite widely with $\bar{R}^2$ values ranging from a low of 0.56 to a high of 0.99 and DW statistic ranging from 0.85 to 2.73. However the standard t and DW tests are not valid for structural estimates of simultaneous equation models, especially in cases where lagged values of the dependent variables are used as explanatory variabes. Yet these statistics are included as a systematic means of evaluating the estimated equations. Because of this failure of the standard tests, greater emphasis had to be placed on the *a priori* specifications of the model, and the model is quite reasonable in this respect.

Production of Raw Jute

$$\text{(1)}\quad ACRBD_t = \underset{(1.92)}{918.27} + \underset{(3.44)}{0.55}\ ACRBD_{t-1} + \underset{(3.57)}{0.69}\ PRJBD_{t-1}$$

$$\underset{(-3.25)}{-0.55}\ PRRBD_{t-1} \underset{(-1.84)}{-480.40}\ SDRAVBD_t$$

$$\underset{(-0.75)}{-119.32}\ RYPABD_{t-1} + \underset{(1.88)}{16.30}\ T$$

$$\underset{(-2.19)}{-554.53}\ DUMBD$$

$$R^2 = 0.75,\quad DW = 1.84,\quad \rho = -0.12$$

$$\text{(2)}\quad ACRIN_t = \underset{(-5.62)}{-36425.73} + \underset{(2.58)}{0.29}\ ACRIN_{t-1}$$

$$+\underset{(8.82)}{1483.13}\ RPRIN_{t-1} \underset{(-2.10)}{-846.99}\ SDRAVIN_t$$

$$+\underset{(4.47)}{2617.56}\ RYPAIN_{t-1} + \underset{(5.57)}{3.93}\ FAPOPIN_t$$

$$\underset{(-4.64)}{-462.57}\ T$$

$$\bar{R}^2 = 0.87,\quad DW = 1.85$$

$$\text{(3)}\quad ACRTH_t = \underset{(-3.34)}{-718.79} + \underset{(2.23)}{0.30}\ ACRTH_{t-1} + \underset{(5.76)}{231.44}\ RPRTH_{t-1}$$

$$+\underset{(2.47)}{900.65}\ RYPATH_{t-1} + \underset{(1.87)}{20.60}\ T$$

$$\bar{R}^2 = 0.90,\quad DW = 2.21,\quad \rho = -0.36$$

$$(4)\quad \underset{}{YPAJBD_t} = \underset{(12.62)}{0.74} - \underset{(-3.22)}{0.0001}\, ACRBD_t + \underset{(3.16)}{0.017}\, T$$
$$- \underset{(-3.88)}{0.0007}\, T^2 - \underset{(-3.31)}{0.134}\, DUMBD$$
$$\bar{R}^2 = 0.74, \quad DW = 1.32$$

$$(5)\quad YPAJIN_t = \underset{(10.97)}{0.45} - \underset{(-0.50)}{0.000007}\, ACRIN_t + \underset{(1.31)}{0.005}\, T$$
$$- \underset{(-2.62)}{0.0004}\, T^2 - \underset{(-2.24)}{0.054}\, DUMIN$$
$$\bar{R}^2 = 0.67, \quad DW = 2.14$$

$$(6)\quad YPAJTH_t = \underset{(13.23)}{0.53} + \underset{(0.70)}{0.00003}\, ACRTH_t - \underset{(-0.62)}{0.007}\, T$$
$$- \underset{(-0.44)}{0.0003}\, T^2$$
$$\bar{R}^2 = 0.63, \quad DW = 1.70$$

$$(7)\quad JBD_t = ACRBD_t \times YPAJBD_t$$

$$(8)\quad JIN_t = ACRIN_t \times YPAJIN_t$$

$$(9)\quad JTH_t = ACRTH_t \times YPAJTH_t$$

$$(10)\quad JRW_t = \underset{(1.95)}{-109.88} + \underset{(5.00)}{0.75}\, JRW_{t-1} + \underset{(1.96)}{21.31}\, T$$
$$\bar{R}^2 = 0.98, \quad DW = 2.04, \quad \rho = 0.68$$

$$(11)\quad RJW_t = JBD_t + JIN_t + JTH_t + JRW_t$$

Stocks of Raw Jute

$$(12)\quad SRJBD_t = \underset{(-1.87)}{-5.65} + \underset{(3.52)}{0.73}\, SRJBD_{t-1} - \underset{(-2.20)}{0.56}\, \triangle PRJW_t$$
$$+ \underset{(2.61)}{0.21}\, RJUJMBD_t - \underset{(-3.99)}{0.94}\, \triangle RJUJMBD$$
$$+ \underset{(1.82)}{0.41}\, DEVNPBD_t + \underset{(1.97)}{278.16}\, DUMBD$$
$$R^2 = 0.87, \quad DW = 2.56, \quad \rho = -0.23$$

$$(13)\quad SRJIN_t = \underset{(1.76)}{213.27} + \underset{(2.89)}{0.52}\ SRJIN_{t-1} - \underset{(-2.27)}{0.24}\ PRJW_t$$

$$+\underset{(2.09)}{0.50}\triangle PRJW_t - \underset{(-2.47)}{0.34}\triangle RJUJMIN_t$$

$$+\underset{(5.64)}{0.75}\ DEVNPIN_t$$

$$\bar{R}^2 = 0.74,\ DW = 1.65,\ \rho = 0.63$$

$$(14)\quad SRJTH_t = \underset{(3.42)}{41.91} + \underset{(6.12)}{0.62}\ SRJTH_{t-1} - \underset{(-2.03)}{0.64}\ PRJW_t$$

$$+\underset{(7.00)}{0.60}\ DEVNPTH_t$$

$$\bar{R}^2 = 0.84,\ DW = 1.86$$

$$(15)\quad WSRJ_t = SRJBD_t + SRJIN_t + SRJTH_t$$

Stocks of Jute Manufactures

$$(16)\quad SJMBD_t = \underset{(-2.14)}{-6.97} + \underset{(5.33)}{0.12}\ PRODJMBD_t + \underset{(1.78)}{0.07}\ SRJBD_t$$

$$\underset{(-2.10)}{-0.04}\triangle SRJBD_t$$

$$\bar{R}^2 = 0.90, \triangle DW = 1.99$$

$$(17)\quad SJMIN_t = \underset{(1.78)}{113.70} + \underset{(1.94)}{0.08}\ PRODJMIN_t + \underset{(1.80)}{0.03}\triangle PRODJMIN_t$$

$$\underset{(-1.93)}{-0.07}\ \triangle SRJIN_t - \underset{(-1.77)}{0.17}\ PJMIN_t$$

$$\bar{R}^2 = 0.56,\ DW = 1.97$$

Consumption of Jute Manufactures and Synthetic Substitutes

$$(18)\quad \ln CONJMBD_t = \underset{(1.67)}{7.05} + \underset{(3.01)}{0.30}\ \ln CONJMBD_{t-1} + \underset{(2.23)}{0.31}\ \ln NIBD_t$$

$$+\underset{(5.19)}{1.43}\ \ln \frac{NIBD_t}{NIBD_{t-1}} - \underset{(-1.92)}{0.88}\ \ln PJMBD_t$$

$$\bar{R}^2 = 0.79,\ DW = 1.81,\ \rho = -0.17$$

$$\text{(19)}\quad \ln CONJMIN_t = \underset{(2.47)}{4.85} + \underset{(1.79)}{0.08} \ln CONJMIN_{t-1} + \underset{(5.91)}{0.84} \ln NINN_t$$

$$\underset{(-2.57)}{-0.29} \ln \frac{NIIN_t}{NIIN_{t-1}} - \underset{(-2.14)}{0.44} \ln PJMIN_t$$

$$\bar{R}^2 = 0.82,\ DW = 1.87$$

$$\text{(20)}\quad CONJSUK_t = \underset{(14.23)}{208.63} + \underset{(3.56)}{0.63} \triangle NIUK_t - \underset{(-1.72)}{1.99} T$$

$$\bar{R}^2 = 0.64,\ DW - 1.82,\ \rho = 0.56$$

$$\text{(21)}\quad CONJSUS_t = \underset{(2.92)}{582.16} + \underset{(4.23)}{0.63} CONJSUS_{t-1} + \underset{(2.64)}{2.07} \triangle NIUS_t$$

$$\underset{(-2.29)}{-5.83} T - \underset{(-2.11)}{0.67} PJSUS_t$$

$$\bar{R}^2 = 0.91,\ DW = 2.38$$

$$\text{(22)}\quad CONJSJN_t = \underset{(-1.99)}{-138.44} + \underset{(2.13)}{0.43} CONJSJN_{t-1} + \underset{(2.41)}{3.54} NIJN_t$$

$$\underset{(-1.61)}{-23.05} T - \underset{(-2.17)}{0.27} PJSJN_t$$

$$\bar{R}^2 = 0.99,\ DW = 1.46$$

$$\text{(23)}\quad CONJSEC_t = \underset{(2.31)}{408.11} + \underset{(1.62)}{0.15} CONJSEC_{t-1} + \underset{(2.53)}{0.56} NIEC_t$$

$$\underset{(1.65)}{+13.31} T - \underset{(-1.62)}{0.49} PJSEC_t$$

$$\bar{R}^2 = 0.99,\ DW = 2.46,\ \rho = 0.21$$

$$\text{(24)}\quad CONJSRW_t = \underset{(2.03)}{18.18} + \underset{(2.23)}{0.57} CONJSRW_{t-1} + \underset{(2.10)}{3.96} \triangle NIRW_t$$

$$\underset{(2.03)}{+99.30} T$$

$$\bar{R}^2 = 0.93,\ WD = 2.16,\ \rho = 0.73$$

$$(25)\quad \ln \frac{CONJMUK_t}{CONSSUK_t} = \underset{(12.17)}{3.60} \; \underset{(-8.43)}{-2.35} \ln \frac{PJMW_t}{PSSW_t}$$

$$\bar{R}^2 = 0.85,\; DW = 0.88$$

$$(26)\quad \ln \frac{CONJMUS_t}{CONSSUS_t} = \underset{(14.66)}{3.79} \underset{(-8.60)}{-2.09} \ln \frac{PJMW_t}{PSSW_t}$$

$$\bar{R}^2 = 0.85,\; DW = 1.11$$

$$(27)\quad \ln \frac{CONJMJN_t}{CONSSJN_t} = \underset{(11.48)}{4.00} \; \underset{(-12.39)}{-4.07} \ln \frac{PJMW_t}{PSSW_t}$$

$$\bar{R}^2 = 0.92,\; DW = 1.47$$

$$(28)\quad \ln \frac{CONJMEC_t}{CONSSEC_t} = \underset{(9.61)}{3.51} \; \underset{(-8.14)}{-2.80} \ln \frac{PJMW_t}{PSSW_t}$$

$$\bar{R}^2 = 0.84,\; DW = 0.85$$

$$(29)\quad \ln \frac{CONJMRW_t}{CONSSRW_t} = \underset{(15.97)}{5.16} \underset{(-8.02)}{-2.44} \ln \frac{PJMW_t}{PSSW_t}$$

$$\bar{R}^2 = 0.83,\; DW = 1.00$$

Production of Jute Manufactures

$$(30)\quad PRODJMBD_t = \underset{(1.83)}{165.72} + \underset{(4.94)}{0.85}\, PRODJMBD_{t-1} \underset{(-1.57)}{-43.04} \frac{PJMBD_t}{PRJBD_t}$$

$$+ \underset{(1.88)}{72.05}\, \Delta \frac{PJMBD_t}{PRJBD_t} \underset{(-4.03)}{-266.27}\; DUMBD$$

$$\bar{R}^2 = 0.86,\; DW = 2.09,\quad \rho = -0.35$$

$$(31)\quad PRODJMIN_t = \underset{(2.27)}{72.88} + \underset{(4.86)}{0.86}\ PRODJMIN_{t-1} + \underset{(1.94)}{94.80}\ \frac{PJMIN_t}{PRJIN_t}$$

$$+ \underset{(1.96)}{83.70} \triangle \frac{PJMIN_t}{PRJIN_t} - \underset{(-2.34)}{0.30}\ SJMIN_{t-1} + \underset{(-2.02)}{3.62}\ T$$

$$\bar{R}^2 = 0.63,\ DW = 2.17$$

$$(32)\quad PRODJMRW_t = \underset{(-1.65)}{-440.44} + \underset{(7.86)}{0.84}\ PRODJMRW_{t-1} + \underset{(2.02)}{343.55}\ \frac{PJMW_t}{PRJW_t}$$

$$\underset{(-1.63)}{-242.58} \triangle \frac{PJMW_t}{PRJW_t}$$

$$\bar{R}^2 = 0.95,\ DW = 1.85$$

$$(33)\quad PRODJMUK_t = \underset{(7.54)}{119.06} + \underset{(2.04)}{0.24}\ PRODJMUK_{t-1} - \underset{(-4.65)}{3.01}\ TIME$$

$$\underset{(-1.56)}{-28.63}\ DUMUK$$

$$\bar{R}^2 = 0.64,\ DW = 1.89$$

$$(34)\quad PRODJMUS_t = \underset{(5.24)}{57.41} + \underset{(1.82)}{0.24}\ PRODJMUS_{t-1} - \underset{(-3.83)}{2.13}\ TIME$$

$$\underset{(-2.13)}{-31.43}\ DUMUS$$

$$\bar{R}^2 = 0.61,\ DW = 1.73$$

$$(35)\quad PRODJMJN_t = \underset{(2.70)}{14.20} + \underset{(7.37)}{0.98}\ PRODJMJN_{t-1} - \underset{(-2.47)}{0.95}\ TIME$$

$$\bar{R}^2 = 0.87,\ DW = 2.14$$

$$(36)\quad PRODJMEC_t = \underset{(4.36)}{300.40} + \underset{(1.74)}{0.06}\ PRODJMEC_{t-1} - \underset{(-1.87)}{4.71}\ TIME$$

$$\underset{(-3.02)}{-66.16}\ DUMEC$$

$$\bar{R}^2 = 0.61,\ DW = 1.57\quad \rho = 0.66$$

Prices of Raw Jute and Jute Manufactures

$$(37)\quad PRJW_t = \underset{(15.62)}{421.072} - \underset{(-2.08)}{161.10}\ \frac{WSRJ_t}{WCRJ_t} - \underset{(-6.76)}{7.32}\ TIME + \underset{(5.62)}{204.85}\ KOREA$$

$\bar{R}^2 = 0.87$, $DW = 1.54$

$$(38)\quad PJMW_t = \underset{(4.12)}{234.18} + \underset{(6.83)}{1.27}\ PRJW_t + \underset{(3.64)}{192.39}\ KOREA + \underset{(1.98)}{67.29}\ DUM$$

$\bar{R}^2 = 0.86$, $DW = 1.23$

$$(39)\quad \ln PRJBD_t = \underset{(1.73)}{-1.08} + \underset{(9.37)}{1.06} \ln (PRJW_t - EXDTBD_t - FRBD_t) + \underset{(6.04)}{1.06} \ln ERBD_t - \underset{(-2.10)}{0.68}\ KOREA + \underset{(4.58)}{1.15}\ DUMBD$$

$\bar{R}^2 = 0.95$, $DW = 1.80$, $\rho = 0.64$

$$(40)\quad \ln PRJIN_t = \underset{(2.48)}{2.65} + \underset{(3.27)}{0.57} \ln (PRJW_t - EXDTIN_t - FRIN_t) + \underset{(2.51)}{0.64} \ln ERIN_t + \underset{(4.25)}{1.15}\ DUMIN$$

$\bar{R}^2 = 0.93$, $DW = 2.73$, $\rho = 0.84$

$$(41)\quad \ln PRJTH_t = \underset{(-1.96)}{-18.77} + \underset{(2.44)}{0.96} \ln (PRJW_t - EXDTTH_t - FRTH_t) + \underset{(2.16)}{7.03} \ln ERTH_t + \underset{(2.93)}{0.69}\ DUMTH$$

$\bar{R}^2 = 0.72$, $DW = 2.41$, $\rho = 0.49$

$$(42)\quad \ln PJMBD_t = \underset{(1.71)}{1.67} + \underset{(1.94)}{0.59} \ln (PJMW_t - EXDTBD_t - FRBD_t)$$

$$+ \underset{(8.76)}{1.31} \ln ERBD_t + \underset{(2.46)}{0.22}\ DUMBD$$

$$\bar{R}^2 = 0.83;\quad DW = 1.71$$

$$(43)\quad \ln PJMIN_t = \underset{(2.34)}{3.98} + \underset{(2.79)}{0.62} \ln (PJMW_t - EXDTIN_t - FRIN_t)$$

$$+ \underset{(2.00)}{0.55} \ln ERIN_t + \underset{(2.50)}{0.16}\ DUMIN$$

$$\bar{R}^2 = 0.93,\quad DW = 1.51,\quad \rho = 0.96$$

$$(44)\quad NEXRJ_{it} = J_{it} - TDURJ_{it} + SRJ_{it-1} - SRJ_{it}$$

$$(45)\quad TDURJ_{it} = RJUJM_{it} + OTHURJ_{it}$$

$$(46)\quad RJUJM_{it} = 1.07\ PRODJM_{it}$$

$$(47)\quad NEXJM_{it} = PRODJM_{it} - CONJM_{it} + SJM_{it-1} - SJM_{it}$$

$$(48)\quad WCJM_t = CONJMBD_t + CONJMIN_t + CONJMUK_t + CONJMUS_t + CONJMJN_t + CONJMEC_t + CONJMRW_t$$

$$(49)\quad WCRJ_t = 1.07\ WCJM_t$$

$$(50)\quad PRODJMW_t = PRODJMBD_t + PRODJMIN_t + PRODJMUK_t + PRODJMUS_t + PRODJMJN_t + PRODJMEC_t + PRODJMRW_t$$

The inclusion of explicit price equations for raw jute and jute manufactures in the model necessitated the omission of the market clearing constraints of $\sum_{i=1}^{8} NEXRJ_{it} = \sum_{i=1}^{7} NEXJM_{it} = 0$, for each t. However, the extent to which the

constraints are violated might be an useful gauge of the performance of the model. In order to test this, the sum of net exports over all countries was calculated for each year for both the 1961-73 and 1974-90 simulation periods and in no case did the discrepancy amount to more than 0.01 per cent of total exports. This indicates the degree of consistency achieved in the model.

In the following simulation, the model defined above has been termed as the basic model and is used as a point of reference. All simulations in this study are nonstochastic. In Table II are presented the annual percentage differences and mean absolute percentage differences between the actual values and the basic simulated values for key aggregate variables over the 1961-73 sample period. In order to limit the variables to a manageable number, in discussing this and subsequent simulations, attention is focused on a few key aggregate variables. Although there are a few large discrepancies, the magnitude of the percentage differences suggest that these simulated values are quite satisfactory. Next, simulations are conducted under three hypothetical situations and are compared with the basic simulation.

Simulation A : The maintenance of a world floor price for raw jute at US $350 per metric ton, accomplished by the absorption of raw jute by an international agency.

The effect of such assumptions on key variables in the world jute economy are compared with the basic simulation values in Table III.

Simulation B : The use of an international buffer stock to maintain the world floor price for raw jute at US $350 per ton, and a world ceiling price five per cent higher, at US $367.50.

Table IV provides a basis for comparison of this simulation with the basic simulation in terms of the key aggregate variables.

Simulation C : Reduction by ten per cent in the price received by all raw jute producers.

The effects of such a scheme on key variables in the jute economy in comparison with the basic simulation are presented in Table V.

Finally, simulations over the 17-year period from 1974 through 1990 are investigated in order to obtain conditional forecasts and to explore further some of the hypothetical situations discussed above. Before discussing the actual simulations, the assumptions which are made about the exogenous variables in these simulations are outlined.

TABLE II

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN ACTUAL VALUES AND BASIC SIMULATED VALUES FOR KEY VARIABLES IN THE WORLD JUTE ECONOMY, 1961-73[a]

	RAW JUTE			JUTE MANUFACTURES		
	RJW	WSRJ	PRJW	PRODJMW	WCJM	PJMW
1961	3.29	-6.31	-10.09	-1.69	-3.21	-1.78
1962	4.85	-5.27	-2.63	-2.14	1.18	3.84
1963	-2.53	3.98	4.38	-4.03	1.56	3.57
1964	1.83	-2.21	-9.62	-1.21	-4.03	-3.60
1965	2.69	2.07	-0.58	-0.72	0.89	2.03
1966	1.98	-2.78	-4.98	3.80	-2.80	-3.51
1967	0.38	0.83	6.96	0.80	0.15	-0.47
1968	15.40	3.47	0.15	2.77	-0.11	1.88
1969	-2.99	5.23	8.86	-3.65	3.12	4.92
1970	3.12	3.85	9.04	3.05	4.85	6.70
1971	-2.87	11.57	4.66	2.39	-0.04	-1.57
1972	-7.98	-3.56	13.60	-4.15	3.03	-10.18
1973	-5.92	-5.30	1.82	-0.39	-1.04	1.64
Mean Absolute % Difference, 1961-73	4.29	4.34	5.95	2.37	2.00	3.51

[a]All percentage differences are the simulated values minus the actual value relative to the actual value, in percentage terms. Variable definitions are given in Appendix A.

TABLE III

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN BASIC SIMULATION AND SIMULATION *A* FOR KEY VARIABLES IN THE WORLD JUTE ECONOMY, 1961-73[a]

	RAW JUTE					JUTE MANUFACTURES		
Year	RJW	WSRJ	PRJW	RJW x PRJW	Buffer Stock Changes (in thousands of metric tons)	PRODJMW	WCJM	PJMW
1961	0.00	-8.96	13.16	13.16	75.48	25.74	-3.91	8.15
1962	12.97	28.92	15.05	29.97	0.00	6.49	-1.61	9.08
1963	16.98	-4.53	9.54	28.14	30.68	3.34	-0.33	5.83
1964	10.07	0.58	10.64	21.78	0.00	-1.08	-3.81	6.59
1965	5.37	-10.23	2.44	7.94	58.04	7.54	-0.52	1.33
1966	3.87	4.49	5.24	9.32	0.00	10.06	-3.69	2.80
1967	2.64	19.48	7.50	10.34	0.00	7.07	-1.62	4.36
1968	5.25	-41.40	-0.15	5.09	145.21	11.94	-0.41	-0.09
1969	2.70	22.73	-4.14	-1.56	0.00	5.43	0.34	-2.43
1970	2.39	-19.69	-4.38	-2.09	151.14	4.28	1.33	-2.23
1971	0.28	73.34	-4.45	-4.72	0.00	-1.69	-5.15	-2.20
1972	2.81	-18.98	-11.97	-14.44	123.76	-9.71	1.95	-6.65
1973	8.93	-9.06	-1.79	-10.56	112.02	-1.42	-1.81	-0.93
Mean Absolute % Difference, 1961-73	5.10	20.16	6.96	12.24	53.56	7.37	2.04	4.05

[a]Variable definitions are given in Appendix A. All percentage differences are the simulation A value minus the basic simulation value, relative to the basic simulation value. In simulation A a floor of U.S. $350 per metric ton for the world raw jute price is maintained by the absorption of stocks of raw jute for the market by an international agency, whenever necessary.

TABLE IV

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN BASIC SIMULATION AND SIMULATION *B* FOR KEY VARIABLES IN WORLD JUTE ECONOMY, 1961-73[a]

	RAW JUTE					JUTE MANUFACTURES		
Year	RJW	WSRJ	PRJW	RJW x PRJW	Buffer Sstocks (in thousands of metric tons)	PRODJMW	WCJM	PJMW
1961	0.00	-8.48	13.16	13.16	71.46	27.94	-3.93	8.15
1962	11.49	28.62	15.04	28.26	-251.34	8.85	-1.54	9.08
1963	11.06	-4.53	9.53	21.65	30.67	7.67	-0.34	5.83
1964	6.40	2.49	7.09	13.95	-12.99	0.19	-3.33	4.39
1965	2.84	-11.53	2.44	5.35	65.43	8.26	-0.61	1.33
1966	1.84	4.58	4.91	6.84	-39.18	5.99	-3.58	2.62
1967	1.62	19.41	7.50	9.24	-164.79	6.15	-1.49	4.35
1968	5.41	-41.20	-0.42	4.96	144.53	8.92	-0.31	-0.25
1969	-1.47	22.62	-4.15	-5.56	-98.52	9.38	0.49	-2.43
1970	0.26	-19.61	-4.38	-4.13	150.64	1.49	1.20	-2.23
1971	-1.07	73.40	-4.61	-5.63	430.75	-4.10	3.50	-2.27
1972	0.53	-19.08	-11.81	-11.35	124.38	-5.77	12.48	-6.56
1973	-2.36	-8.84	-3.08	-5.37	109.37	-0.81	8.54	-1.60
Mean Absolute % Difference 1961-73	3.57	20.34	6.98	10.42	130.30	7.35	3.18	3.93

[a]Variable definitions are given in Appendix A. All percentage differences are the simulation B value minus the basic simulatnio value, relative to the basic simulation value. In simulation B a floor price of U.S. $ 350 per metric ton and a ceiling at a 5 per cent higher for the price of raw jute is maintained by purchases and sales of raw jute by an internatioal buffer stock agency.

TABLE V

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN BASIC SIMULATION AND SIMULATION *C* FOR KEY VARIABLES IN THE WORLD JUTE ECONOMY, 1961-73[a]

	RAW JUTE				JUTE MANUFACTURES		
Year	RJW	WSRJ	PRJW	RJWx PRJW	PRODJMW	WCJM	PJMW
1961	-6.68	-4.74	1.84	-4.97	2.61	-0.34	0.31
1962	-4.62	-4.22	2.67	-2.07	1.13	-0.09	1.43
1963	-4.64	-3.88	3.35	-1.44	1.01	-0.18	2.01
1964	-4.35	3.97	2.87	-1.61	0.12	-2.18	1.08
1965	-4.20	-3.52	3.62	-0.54	0.97	1.27	1.98
1966	-3.93	1.56	2.23	-1.78	0.69	-2.07	1.02
1967	-3.48	-0.38	3.68	0.08	0.83	2.52	1.85
1968	-2.54	5.57	3.70	1.06	1.94	1.67	1.91
1969	-4.92	4.75	-0.76	-5.64	-0.11	-3.03	-0.46
1970	-2.86	1.56	-0.80	-3.64	-1.13	4.26	-0.42
1971	-4.23	4.03	-0.43	-4.65	-3.16	6.03	-0.21
1972	-0.34	7.66	-0.36	-0.70	-4.84	1.53	-0.28
1973	-6.34	0.37	-1.50	-7.75	-0.08	1.08	-0.98
Mean Absolute % Difference 1961-73	4.07	3.56	2.14	2.76	1.43	2.02	1.07

[a]Variable definitions are given in Appendix A. All percentage differences are the simulation C value minus the basic simulation value relative to the basic simulation value. In simulation C a disincentive to raw jute production is provided by a ten per cent reduction in the actual price received by all the raw jute producers throughout the simulation period.

Assumptions about the Exogenous Variables

The assumptions about the exogenous variables which are made throughout this and the following sections (unless otherwise noted) are as follows :

(1) PRRBD — domestic deflated price of rice in Bangladesh — actual values are used for the period 1974-76. After 1976 the price is assumed constant in real terms at the 1974-76 average level (Taka 1053.96 per metric ton). The cost of living index in Bangladesh increases from 1976 actual level at the average annual rate of 15 per cent. During 1974-76 actual figures are used.

(2) $SDRAV_i$ — standard deviation of relative acre value — actual figures are used during 1974-76 ; after 1976 the value is held constant at the average of the 1974-76 level for both Bangladesh and India (0.25 and 0.23 respectively).

(3) $RYPA_i$ — relative yield rates of jute compared to rice — actual figures are used during 1974-76 ; after 1976, held constant at the average of the levels during 1974-76, for all the three producing countries of Bangladesh, India, and Thailand (the average levels are 1.35, 0.85, and 0.40 respectively).

(4) PRR_i — domestic prices of rice or other alternative crops for India and Thailand — actual figures are used for 1974-76 ; after 1976 the variable is assumed constant at the real average level during 1974-76.

(5) T — Time trend variable — increasing monotonically with equal increments for production of jute manufactures equations. In all other cases the value is frozen at the actual 1977 level.

(6) $FAPOP_i$ — farm population in India — actual values are used during 1974-76 after which it increases at the average annual rate of 2 per cent.

(7) DUM — dummy variable — set equal to zero.

(8) $YPAJ_i$ — yield per acre of jute — actual values are used durig 1974-76 for all three producing countries ; after 1976 the level for each is held constant at the average of the 1974-76 levels — (0.49, 04.0 and 0.42 for Bangladesh, India and Thailand respectively).

(9) $DEVNP_i$ — deviation from normal production of raw jute — assumed zero for all the three countries of Bangladesh, India and Thailand.

(10) $OTHURJ_i$ — other miscellaneous uses of raw jute in Bangladesh and India — held constant at the average level of 30 and 54 thousand metric tons respectively.

(11) NI_i — real national incomes — for Bangladesh and India increasing annually by the average annual rate during 1965-73 (1.5 per cent and 2 per cent respectively). For U.K., and E.E.C. countries, U.S.A., Japan and "Rest-of-the-World" sector, increasing at the annual rates of 3.5, 3.5, 4.0, 5.0, and 2.5 per cent respectively.

(12) PJS_i — composite real prices of jute manufactures and synthetic substitutes — actual figures are used during 1974-76 ; after 1976 the variable is assumed constant at the average of its 1974-76 levels for U.S.A., Japan, and E.E.C. countries.

(13) PSSW — price of synthetic substitutes — actual values are used during 1974-76. From 1977 onwards, assumed constant in real terms at the 1977 level. The index of raw material prices used to deflate the PRJW variable increases by 3 per cent per year over the 1976 level. During 1974-76, actual figures are used.

(14) ER_i — exchange rates — actual values are used during 1974-76. From 1977 onwards, the prevailing exchange rates during 1977 are used.

(15) $EXDT_i$ — export duties on raw jute and jute manufactures — actual figures are used during 1974-76. After 1976, the actual figures for 1977 are used.

(16) FR_i — freight charges — prevailing rates during 1975 are used.

(17) KOREA — dummy for Korean War — set equal to zero.

Except where noted explicitly the basic model for all of the post-1974 simulations is identical to the model outlined above with the following exceptions : the yield per acre of jute equations are dropped and substituted with constant values, the production of jute manufactures in the U.K., U.S.A., and Japan are assumed not to fall below 40, 10, and 30 thousand metric tons respectively during the simulation period, and the assumptions about the exogeneous variables outlined above are maintained. Although the model has limitations in respect to forecasts for as many as 17 years outside of the sample period, it incorporates most of the essential and most interesting features of the international jute market, the interacting effects of which could not be examined easily within the framework of most other forecasting procedures. The simulated annual values for key variables are presented in Table VI and the annual percentage values with respect to the simulated 1974 values for the same variables are presented in Table VII. These forecasts compare quite favourably with other projections which are presented in Table VIII.

V. CONCLUDING REMARKS

The overall picture that emerges from the basic simulation of the 1974-90 period is that the world market for jute during the period is not expected to change much. Levels of production and consumption during the period would increase only marginally with prices remaining more or less stable. Thus the prospects of any substantial increase in the foreign exchange earnings from the exports of jute by the major producing countries would appear unrealistic. Moreover, the traditional role of Bangladesh and India as the major supplier of raw jute and jute manufactures, respectively, will be further diminished. With production more diversified, the major causes of wide fluctuations in the price level originating in the supply side will be few.

The possible institution of various international agreements to benefit (in part, at least) the jute producing nations has been a subject of considerable interest in many quarters. In the recent past, mostly as a result of the UNCTAD Integrated Programme for Commodities, there has been a revival of interest in international commodity trading arrangements—buffer stocks in particular—designed to reduce short-term fluctuations in the prices of primary commodities exported by developing countries. A few variants of such agreements in comparison with the basic simulations are also examined. The three variants of international raw jute market organisation, Simulations A,B and C, which are investigated above are further explored for the 1974-90 period and the results are summarised in Tables IX, X and XI respectively. However, it has been found that in most cases these programmes will have very limited benefits (although both producers and consumers might benefit from increased price stability) due to high and increasing elasticity of substitution. This leaves the only potential for relative gains for jute producers in reducing prices through decrease in costs of production. The scope for such decreases are wide, since jute is still produced under subsistence agriculture with relatively few modern inputs.

While there remains many further scopes for developments in the model, it is highly promising that the simple aggregate model constructed here is able to describe many aspects of the behaviour of the world jute market over the period and observe serveral dynamic behaviour properties which are substantially in accord with prior notions. While the model cannot be considered definitive in any sense, it reveals a surprising richness of response properties and is thus a step in the direction of comprehensive modelling of the world jute economy.

TABLE VI

BASIC ANNUAL SIMULATED VALUES FOR KEY VARIABLES IN THE WORLD JUTE MARKET, 1974-90[a]

	RAW JUTE			JUTE MANUFACTURES		
Year	RJW	WSRJ	PRJW	PRODJMW	WCJM	PJMW
1974	3965.3	1147.4	299.9	3543.0	3691.9	485.7
1975	3979.1	1009.6	302.7	3653.7	3660.4	483.1
1976	4192.7	914.2	338.8	3722.4	3727.6	507.5
1977	4323.4	863.9	326.1	3800.6	3794.1	492.3
1978	4211.3	824.1	358.1	3749.0	3751.5	512.4
1979	4360.1	803.2	360.4	3792.5	3783.3	509.2
1980	4401.4	797.3	361.8	3833.2	3827.8	505.3
1981	4427.6	802.9	355.4	3846.4	3839.7	495.9
1982	4453.7	814.7	348.1	3854.4	3851.3	486.1
1983	4507.6	829.1	339.9	3846.8	3841.7	476.0
1984	4511.1	843.7	331.9	3881.1	3874.0	466.4
1985	4522.8	840.7	364.4	3863.5	3865.6	484.9
1986	4522.0	824.1	398.9	3868.6	3871.0	504.4
1987	4494.5	847.3	334.3	3895.3	3880.5	457.0
1988	4509.4	870.2	323.8	3879.3	3885.7	446.7
1989	4457.3	852.7	401.9	3878.9	3889.3	493.9
1990	4509.3	824.9	439.4	3892.5	3889.8	513.8

[a]Variable definitions are given in Appendix A. PRJW and PJMW are in units of current U.S. dollars per metric ton. All other variables are in units of thousands of metric tons.

TABLE VII

BASIC ANNUAL SIMULATED VALUES FOR KEY VARIABLES IN THE WORLD JUTE MARKET AS PERCENTS OF 1974 SIMULATED VALUES, 1974-90[a]

	RAW JUTE			JUTE MANUFACTURES		
Year	RJW	WRSJ	PRJW	PRODJMW	WCJM	PJMW
1974	100.00	100.00	100.00	100.00	100.00	100.00
1975	100.35	87.99	100.93	103.12	99.15	99.47
1976	105.74	79.68	112.97	105.06	100.97	104.49
1977	109.03	75.29	108.72	107.27	102.77	101.36
1978	106.20	71.82	119.40	105.81	101.61	105.50
1979	109.96	70.00	120.17	107.04	102.48	104.84
1980	110.99	69.49	120.61	108.19	103.68	104.04
1981	111.66	69.98	118.49	108.56	104.00	102.10
1982	112.32	71.00	116.07	108.78	104.32	100.08
1983	113.68	72.26	113.34	108.57	104.06	98.00
1984	113.76	73.53	110.65	109.54	104.93	96.03
1985	114.06	73.27	121.49	109.04	104.71	99.84
1986	114.04	71.82	133.03	109.18	104.85	103.85
1987	113.35	73.85	111.46	109.94	105.11	94.09
1988	113.72	75.84	107.97	109.49	105.25	91.97
1989	112.41	74.32	134.02	109.48	105.35	101.69
1990	113.72	71.89	146.50	109.86	105.36	105.79
Annual Constant Exponential Growth Rate between Simulated 1974 & 1990 Values	0.80	—2.06	2.39	0.59	0.33	0.35
Annual Constant Exponential Growth Rate between Actual 1958 and 1974 Values	2.13	3.31	3.14	2.62	2.80	0.63

[a]Variable definitions are given in Appendix A. Percentages are calculated from Table VII.

TABLE VIII

FORECASTS OF PRODUCTION OF RAW JUTE AND JUTE MANUFACTURES AND CONSUMPTION OF JUTE MANUFACTURES FOR 1980 AND 1990 FOR WORLD AND LEADING PRODUCING AND CONSUMING AREAS[a]

Year and Source						
A. Area Under Raw Jute :						
			BD	IN	TH	
1980	Mujeri, Basic Simulation		2035	3331	656	
	FAO[b]		2220	2520	—	
1990	Mujeri, Basic Simulation		2023	2883	777	
B. Production of Raw Jute :						
		W	BD	IN	TH	RW
1980	Mujeri, Basic Simulation	4401	814	1325	275	1918
	FAO[b] Lower[c]	4100	1400	1400	330	970
	Higher[c]	5000	1800	1620	450	1130
	Khan[d]	3915	1505	1617	793	—
1990	Mujeri, Basic Simulation	4509	809	1153	326	2221
C. Production of Jute Manufactures :						
		W	BD	IN	US, UK, JN, EC,	RW
1980	Mujeri, Basic Simulation	3833	483	1160	260	1931
1990	Mujeri, Basic Simulation	3893	517	1094	199	2084

(*Contd.*)

TABLE VIII (*Contd.*)

D. Consumption of Jute Manufactures :

		W	BD	IN	JN	US	UK	EC	RW
1980	Mujeri, Basic Simulation	3828	67	582	59	331	96	181	2482
	IBRD[e] I[f]	3625	40	755	61	410	—280[g]	—	2184
	II[f]	3850	45	755	71	445	—350[g]	—	2184
	FAO[h]	3515	60	705	53	407	66	161	2063
	FAO[b] Basic[i]	4250	—	740	—	530[j]	—475[k]	—	2505
	Supplementary[i]	2750	—	580	—	200[j]	—185[k]	—	1785
	Khan[d]	031	48	680	158	451	192	271	2231
1990	Mujeri, Basic Simulation	3890	76	743	40	317	91	166	2456

a. Variable definitions are given in Appendix A. All figures are in thousands of metric tons.

b. FAO [9].

c. The difference between the two production projection results reflects uncertainty as to the outcome of a single set of price and policy assumptions.

d. Khan [15].

e. IBRD [13].

f. The basic difference between simulations I and II being that II assumes elimination of import restrictions in Western Europe and large imports by China and Africa.

g. Figures are for Western Europe excluding Greece, Turkey and Yugoslavia.

h. FAO [10].

i. Basic projection assumes both a continuing competitiveness of jute with polyolefin materials in developed countries and high rates of growth of marketed output of agricultural products elsewhere. The supplementary projection implies less favourable assumptions.

j. Figures are for North America.

k. Figures relate to Western Europe.

TABLE IX

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN BASIC SIMULATION AND SIMULATION *A* FOR KEY VARIABLES IN THE WORLD JUTE ECONOMY, 1974-90[a]

	RAW JUTE				JUTE MANUFACTURES			
Year	RJW	WSRJ	PRJW	RJW x PRJW	Buffer Stock	PROD JMW	WCJM	PJMW
1974	0.00	1.65	16.70	16.70	18.94	—0.92	1.13	8.65
1975	0.88	—0.17	15.62	17.80	0.00	—1.57	—0.70	8.05
1976	2.69	0.23	3.30	6.08	2.14	—1.52	—0.52	1.78
1977	2.66	0.55	7.34	10.19	4.71	—1.77	—0.57	3.85
1978	2.32	1.61	0.00	2.31	13.24	—1.59	—0.02	0.00
1979	2.41	2.40	0.00	2.41	19.29	—1.48	0.00	0.00
1980	2.19	2..60	0.00	2.19	20.73	—1.37	0.00	0.00
1981	5.45	2.48	0.00	—5.45	19.93	—1.26	0.00	0.00
1982	—1.21	2.14	0.54	—0.68	17.41	—1.18	—0.20	0.28
1983	0.08	1.45	2.97	3.04	12.00	—1.21	—0.36	1.51
1984	0.38	0.62	5.47	5.86	5.22	—1.36	—0.48	2.72
1985	0.71	0.77	0.00	0.71	6.48	—1.23	—0.02	0.00
1986	0.31	1.10	0.00	0.31	9.03	—1.15	—0.36	0.00
1987	0.14	0.58	4.70	4.85	4.88	—1.28	—0.39	2.29
1988	0.54	—0.23	8.08	8.66	0.00	—1.55	—0.56	3.85
1989	0.81	0.11	0.00	0.81	0.91	—1.41	0.00	0.00
1990	0.35	0.77	0.00	0.35	6.35	—1.33	0.00	0.00
Mean Absolute % Difference 1974-90	1941	1.41	3.80	5.70	9.48	1.36	0.31	1.94

[a]Variable definitions are given in Appendix A. All percentage differences are definited to be simulation A minus basic simulation values relative to basic simulation values. In simulation A a raw jute floor price of U.S. $350 per metric ton is maintained by buffer stock purchases.

TABLE X

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN BASIC SIMULATION AND SIMULATION *B* FOR KEY VARIABLES IN THE WORLD JUTE ECONOMY, 1974-90[a]

	RAW JUTE					JUTE MANUFACTURES		
Year	RJW	WSRJ	PRJW	RJW x PRJW	Buffer Stock	PRODJMW	WCJM	PJMW
1974	0.00	1.65	16.70	16.70	18.94	—0.92	1.13	8.65
1975	1.88	—0.17	15.62	17.80	0.00	—1.57	—0.70	8.05
1976	2.69	0.23	3.30	6.08	2.14	—1.52	—0.52	1.78
1977	2.66	0.55	7.34	10.19	4.71	—1.77	—0.57	3.85
1978	2.32	1.61	0.00	2.31	13.24	—1.59	—0.02	0.00
1979	2.41	2.40	0.00	2.41	19.29	—1.48	0.00	0.00
1980	2.19	2.60	0.00	2.19	20.73	—1.37	0.00	0.00
1981	—5.45	2.48	0.00	—5.45	19.93	—1.26	0.00	0.00
1982	—1.21	2.14	0.54	—0.68	17.41	—1.18	—0.29	0.28
1983	0.08	1.45	2.97	3.04	12.00	—1.21	—0.36	1.51
1984	0.38	0.62	5.47	5.86	5.22	—1.36	—0.48	2.72
1985	0.71	0.77	0.00	0.71	6.48	—1.23	—0.02	0.00
1986	0.31	2.42	—7.89	—7.60	—19.93	—0.79	—0.22	—4.23
1987	—0.49	1.25	4.70	4.18	10.61	—0.98	—0.25	2.29
1988	0.24	—0.13	8.08	8.35	1.09	—1.25	—0.57	3.85
1989	0.67	1.27	—8.57	—7.96	—10.82	—0.74	0.10	—4.51
1990	—0.39	4.14	—16.36	—16.69	—34.15	0.03	0.53	—8.91
Mean Absolute % Difference 1974-90	1.41	1.52	5.73	5.73	12.74	1.19	0.33	2.97

[a]Variable definitions are given in Appendix A. All percentage difference are defined to be simulation B minus basic simulation values relative to basic simulation values. In simulaton B, both a price floor at U. S. $350 and a price ceiling at U. S. $367.50 are maintained by buffer stock activities.

TABLE XI

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN BASIC SIMULATION AND SIMULATION *C* FOR KEY VARIABLES IN THE WORLD JUTE ECONOMY, 1974-90[a]

	RAW JUTE			JUTE MANUFACTURES			
Year	RJW	WSRJ	PRJW	RJW x PRJW	PRODJMW	WCJM	PJMW
1974	0.00	—0.04	0.40	0.40	—0.03	—0.68	0.21
1975	—1.69	—0.02	0.17	—1.86	—0.01	—0.81	0.09
1976	—1.86	—0.04	0.22	—2.07	0.00	—1.24	0.12
1977	—1.81	—0.07	0.23	—2.04	0.01	—1.29	0.12
1978	—1.84	—0.07	0.18	—2.04	0.02	—1.13	0.10
1979	—1.91	—0.06	0.17	—2.08	0.03	—1.09	0.09
1980	—1.87	—0.03	0.09	—1.95	0.03	—0.55	0.05
1981	—1.87	—0.01	0.09	—1.95	0.03	—0.54	0.04
1982	—1.85	0.00	0.10	—1.95	0.03	—0.62	0.05
1983	—1.81	—0.01	0.10	—1.91	0.03	—0.58	0.05
1984	—1.75	0.00	0.19	—1.94	0.04	—1.07	0.10
1985	—1.69	—0.01	0.18	—1.87	0.05	—1.08	0.09
1986	—1.71	—0.02	0.22	—1.92	0.05	—1.40	0.12
1987	—1.68	—0.01	0.22	—1.89	0.06	—1.13	0.10
1988	—1.56	0.00	0.24	—1.79	0.07	—1.15	0.11
1989	—1.38	—0.01	0.17	—1.54	0.07	—1.02	0.09
1990	—1.35	—0.02	0.08	—1.43	0.07	—0.59	0.05
Mean Absolute % Difference 1974-90	1.62	0.02	0.17	1.80	0.03	0.93	0.09

[a]Variable definitions are given in Appendix A. All percentage differences are defined to be simulation C minus basic simulation values relative to the basic simulation values. In simulation C, the prices received by the producers of raw jute are reduced by the ten per cent by an appropriate tax.

APPENDIX A

VARIABLE DEFINITIONS

All variables are defined for annual time periods.

All variables are for year t unless otherwise indicated by subscripts. Notation in respect to geographical regions are excluded in order to simplify the definitions except in those cases in which to do so would be confusing.

The definitions of such country notations are as follows :

BD = Bangladesh

IN = India

TH = Thailand

RW = Rest-of-the-World

UK = United Kingdom

US = United States

JN = Japan

EC = European Economic Community (excluding UK)

W = World Total

The definitions of variables are as follows :

ACR = Area under raw jute cultivations in thousands of acres.

PRJ = Domestic price of raw jute received by farmers (in units of domestic currencies per metric ton).

PRR = Domestic price of rice/other alternative crops in units of domestic currencies per metric ton.

SDRAV = Standard deviation of the relative acre value of preceding three years. Relative acre value is calculated as PRJ × YPAJ/PRR × YPAR.

RYPA = YPAJ/YPAR.

T = A time trend variable with T = 1 for first year and incremented by one for each subsequent year.

DUM = Dummy variables with DUM = 1 for the years in which used.

RPR = PRJ/PRR

FAPOP = Farm population (in thousands) in area of concern.

YPAJ = Yield (in metric tons per acre) of jute.

YPAR = Yield of rice (metric tons per acre).

J = Total production of raw jute (in thousands of metric tons)

RJW = Total world production of raw jute in thousand metric tons.

SRJ = End year stocks of raw jute in thousand metric tons.

PRJW = World price of raw jute (in US dollars per metric ton).

RJUJM = Total amount of raw jute used in the production of jute manufactures (in thousand metric tons).

DEVNP = Deviation of actual production from normal production which is measured by a moving average of three preceding years' production of raw jute (in thousand metric tons).

CONJM = Consumption of jute manufactures in thousand metric tons.

NI = Index of national income in 1959/60 prices (1960 = 100).

PJM = Domestic price of jute manufactures per metric ton.

SJM = Stocks of jute manufactures in thousand metric tons.

PRODJM = Production of jute manufactures in thousand metric tons.

CONJS = Total consumption of jute manufactures and synthetic substitutes (in units of jute equivalence) in thousand metric tons.

PJS = Composite price of jute manufactures and synthetic substitutes in US dollars per metric ton.

CONSS = Total consumption of synthetic substitutes in jute end-uses (thousand metric tons).

PJMW = World price of jute manufactures in US dollars per metric ton.

PSSW = World price of synthetics in US dollars per metric ton.

WSRJ = World stock of raw jute.

WCRJ = World consumption of raw jute.

KOREA = Dummy variable for Korean War.

EXDT = Export duty (in US dollars per metric ton) levied by major producers on raw jute and jute manufactures.

FR = Freight charges (US dollars per ton) on transportation of raw jute and jute manufactures from producing countries to England.

ER = Exchange rate (expressed in units of domestic currency per US dollars).

NEXRJ = Net exports of raw jute.

TDURJ = Total domestic uses of raw jute.

OTHURJ = Other exogenous uses of raw jute.

NEXJM = Net exports of jute manufactures.

WCJM = World consumption of jute manufactures.

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Comparative Advantage of Bangladesh Within the Manufacturing Sector*

by

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The foreign trade regime of Bangladesh is characterised by fixed exchange rate, a reliance on both tariff and quota for limiting imports and ad hoc export incentive measures. It is often hypothesised that this kind of policy syndrome creates a distorted structure of incentives leading to a pattern of industrial growth which does not conform to comparative advantage. This paper attempts to test the validity of the hypothesis in the context of Bangladesh. Empirical measurement of comparative advantage in this study is based on Domestic Resource Cost (DRC). A sector is considered to enjoy comparative advantage if its DRC is positive and less than the shadow price of foreign exchange. On the basis of a survey of 62 manufacturing sectors, it is found that the DRC turns out to be negative for as many as 18 sectors, including one important sector, cigarette. There are 19 sectors with long-run DRC values positive, but higher than the shadow price of foreign exchange indicating lack of comparative advantage. Some important sectors in this group are steel, matches and paper. Only 25 sectors demonstrate long run comparative advantage. The findings, therefore, confirm the hypothesis that the pattern of industrial growth in Bangladesh does not conform to comparative advantage.

I. INTRODUCTION

The foreign trade regime of Bangladesh is characterized by a fixed exchange rate, a reliance on both tariff and quota for limiting imports and ad hoc export incentive measures in the face of persistent deficit in the balance of trade. Import regulations as well as export incentives are highly product specific. This kind of policy syndrome usually creates distorted structure of incentives. The resultant pattern of industrial growth may not conform to the country's comparative advantage in the international trade.

But healthy industrial growth requires that the country directs its limited resources into activities in which it enjoys comparative advantage. This paper makes an

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attempt to evaluate the existing manufacturing activities of Bangladesh with a view to determining if they conform to comparative advantage. The paper is divided into five sections. Section II provides the rationale for adopting Domestic Resource Cost (DRC) as the measure of comparative advantage and indicates some of the limitations to this approach. Section III describes the data sources and methodology used in estimating comparative advantage and Section IV analyses the findings of the study. Some concluding remarks are presented in Section V.

II. COMPARATIVE ADVANTAGE AND DOMESTIC RESOURCE COST

The concept of comparative advantages as expounded in economic literature, is not free from ambiguity. It is not intended to attempt a survey of literature on the relative merits and demerits of various approaches to comparative advantage. Only a few observations will be made, essentially by way of an attempt to identify comparative advantage for Bangladesh.

Traditional Approaches to Comparative Advantage

Ricardian theory focussed basically on factor (labour) efficiency and the particular model that he had set up made inter-country differences in factor endowment and demand conditions irrelevant in view of the assumptions of a single factor and constant cost. Heckscher-Ohlin theory, on the contrary, assumed international identity of production functions for any given commodity and argued that a country's comparative advantage lay in exporting (importing) commodities which used more intensively its relatively more (less) abundant factor of production. The ultimate rationale behind both the approaches lies in the proposition that a country should export that commodity whose domestic pre-trade relative price is cheaper. The empirical application of the relative price criterion is confronted with the following problems :

(i) The observed prices are always post-trade prices [1]. Further, price in each country suffers from varying degrees of distortion arising out of domestic monetary/fiscal policies, presence of monopoly, international trade policies etc., which create wedge between the observed prices and the competitive prices in terms of which these models are conceived.

(ii) In a multi-country framework, it is impossible to determine *a priori* whether the comparison of prices should be between the country concerned and all other countries of the world taken together or only the trading partners taken together or each of the trading partners individually.

Another approach to comparative advantage is based on what has been termed as "Neo-technology Models" [8]. The basic proposition of these models is that

the LDCs would enjoy comparative adventage in only those products whose production process has become sufficiently standardized at a point at which the product becomes labour intensive. If this criterion were to be adopted, Bangladesh would have to look for and obtain the right to use patents for such standardized products. Such rig may not be obtainable without direct participation by the innovator-multi-nationals. Investment by multi-nationals deserves to be evaluated from the host country's point of view, taking into account such factors as taxes paid by them, repatriation of profits and/or principal etc. [9]. These models by themselves do not provide any criterion for such evaluation, nor do they provide any basis for screening out the activities which are already being undertaken by Bangladesh.

Domestic Resource Cost as an Alternative Approach

In consideration of the above and of what follows, it has been decided to use in this study the other major approach most frequently used for empirical measurement of comparative advantage—Domestic Resource Cost (DRC). This concept, based on total factor productivity approach, also introduces factor abundance/scarcity through the use of shadow prices.

Developed first in the early 1950's and formalized by Bruno [2], DRC measures the cost, in terms of domestic factors of production, of earning or saving a net unit of foreign exchange in a particular project or stage of production. Some years later, the technique was shown to precisely correspond to comparative advantage for a small country producing many commodities, provided the factors of production were valued at the social opportunity cost and the DRC measure was compared to shadow price of foreign exchange to provide a cut-off criterion. This approach can claim the following advantages :

(i) This measure of comparative advantage can be more easily estimated in a multi-country, multi-commodity, multi-factor world.

(ii) It can take into account international factor mobility through suitable adjustment in shadow prices.

(iii) In Bangladesh, selection of projects is frequently based on the consideration of foreign exchange earnings or savings. The DRC criterion, by taking into account not only foreign exchange earnings or savings but also constrained avaliability of certain domestic resources and the requirements of imported materials, makes possible an activity by activity evaluation to indicate whether it is in the country's interest to promote a particular industry or a particular stage of production for export or for import substitution. Thus a more rational basis is provided for

project selection without losing sight of the need to earn or save foreign exchange.

(iv) It appears that the requirements of data can be met more easily.

Limitations to DRC Approach

Having made the choice in favour of DRC, it is necessary to point out some of the problems associated with applying the DRC concept. It will be useful to bear these considerations in mind while evaluating the findings of this study.

(i) Use of Foreign Countries' Input Coefficients

The application of the observed input/output table to estimate DRC also involves an implicit assumption of fixed coefficient production function. But if substitution between inputs is possible, the observed coefficients may not be relevant under a different set of policy regime. One way of handling this problem is to use the input coefficients of another country in which prices are not as much distorted by trade policies [5]. In practice, it is difficult to find any country where prices have not been distorted at all. Even if one chooses a country where prices are relatively less distorted, possible differences in inter-country production functions and differential transport cost as between finished product and material inputs detract from the usefulness of such procedure [18]. Considering these problems and the constraints of the present study, it is intended to use the coefficients observed in Bangladesh.

(ii) Non-existing Industries

A related issue of importance is that a country's full comparative advantage may not be exploited unless activities not currently appearing within the country are also evaluated [23]. This is of particular relevance for Bangladesh where the present manufacturing sector is very small. Nonetheless, it remains important to evaluate the comparative advantage of the existing activities, however small their size may be, because the decision regarding future expansion/contraction should be made on the basis of this evaluation. This study is concerned only with the existing activities.

(iii) Dynamic Considerations

One important criticism against the DRC measure is that it is a static measure focusing on comparative advantage at a given moment. Over time the input coefficients as well as the shadow prices change, partly because of policy induced changes and/or autonomous change in factor supplies. Exogenous movements in the world terms of trade and in the economies of scale, particularly of the learning-by-doing type, also affect comparative advantage of a country. These factors have not been taken into account.

When a particular domestic resource cost is related to a particular world price to obtain a single domestic resource cost of foreign exchange, the observation used may naturally be an average of a number of years or it may be an observation of a particular single year, quarter, month or instant. As a result, the DRC is not able to easily handle problems such as differences in gestation periods, changes in coefficients over time, changes in prices over time, differences between the financial and real flows at different moments in time, etc. Whenever such elements are important, recourse needs to be had to more complicated weighting systems to develop appropriate averages, with all the attandant index number problems and the interpretation issues that follow such procedures.

Choice between Total and Direct Domestic Resource Cost

Another issue which requires consideration is the distinction between Direct Domestic Resource Cost (DDRC) and Total Domestic Resource Cost (TDRC). The TDRC is defined as the ratio of direct plus indirect value added at the domestic prices to value added at the international prices taking into account the direct as well as the indirect input requirements. The DDRC, on the contrary, includes in the numerator only the direct value added and only the direct inputs at the world price in the denominator. The distinction is important because if one activity uses an input domestically produced under protection by another activity, the former activity, may be rejected by the TDRC measure while being accepted by the DDRC measure. This happens because protection artificially inflates the domestic value added component of the inefficient input producing activity and because the TDRC includes it in the numerator. If the domestic industries are constrained to use inefficiently produced domestic inputs, one may argue that the TDRC should be the appropriate measure because the effect of the constraint should be specifically taken into account. However, this involves an assumption that domestically produced inputs will continue to be used and will continue to remain inefficient. If the incremental input requirements are, in fact, met from imports, the TDRC measure will cease to be relevant. Furthermore, since this study is oriented to designing trade policy, it does not seem conducive to the objective pursued to constrain the sourcing of inputs and to vertically integrate industries that could very well benefit from trade in intermediate products. Thus, every transformation activity will be left to stand on its own and only the direct domestic resource costs will be calculated. Indeed, this procedure will be followed even if, in fact, all the inputs for a particular stage of transformation are domestically sourced, for the purpose is to test precisely whether that sourcing pattern is desirable or not.

Having established this general principle, it is important to immediately notice one major caveat : non-traded goods not being procurable from abroad, their sourcing is perforce domestic. In consequence, any increase in a user industry of a non-traded sector will require expansion of output in that non-traded sector. One could also argue that the production of non-traded supplying sectors will not expand

and that, instead, some of the existing supplies will be bid away from their current uses and into the new using sector. While this outcome is also plausible, it seems to be more consistent with a multi-sectoral planning approach, such as the design of trade policy, to assume that the production capacity will be expanded and put in place as required by the user industries. Should there be a particular reason to expect the contrary, the standard procedure that is being adopted here would need to be modified.

The case of non-traded inputs is, therefore, an exception to the general rule of excluding vertical integration. For the particular case of non-traded goods, the user industries will be assumed to be vertically integrated with their suppliers. This means that the DRC numerator in this study will contain the direct and indirect value added of non-traded supplying sectors in addition to direct value added of the industry concerned. Likewise, that denominator will contain the world price value of the output minus the direct and indirect material inputs required by non-traded supplying sectors as well as direct material inputs required by the industry concerned.

III. DATA : SOURCES AND PREPARATION

The DRC, as formulated in the present study, can be written as follows :

$$DRC_j = \frac{\Sigma P_i F_{ij} + \Sigma A_j^{NT}}{\Sigma P_j - \Sigma TR_{ij} - \Sigma A_j^{T}}$$

where P_i = the shadow price of the i^{th} primary factor in the local currency ;

F_{ij} = the amount of the i^{th} primary factor directly used in the production of the j^{th} sector's outputs ;

ΣA_j^{NT} = both the direct and the indirect factor use of non-tradables used in the j^{th} sector valued at the shadow prices in the local currency;

ΣP_j = the value of the j^{th} sector's outputs at the world price in the local currency at the official exchange rate. The summation sign is meant to take into account multiple outputs ;

ΣTR_{ij} = the value of the tradable inputs directly used in the j^{th} sector at the world prices in the local currency at the official exchange rate ;

ΣA_j^{T} = the direct and the indirect use of the tradable inputs by the non-tradables used in the j^{th} sector valued at the world prices in the local currency at the official exchange rate.

If the above ratio is positive and less than the multiplier (α) which converts the official exchange rate into the shadow exchange rate, the sector will be considered socially profitable.[1] A negative DRC implies a net loss of foreign exchange and hence the sector deserves to be closed down.

From the above, it can be seen that the data requirements are as follows :

(i) the primary factor requirements and their associated shadow prices;[2]

(ii) the material input requirements ;

(iii) the factor requirements and the intermediate input use of the non-tradables ; and

(iv) the world prices of all the outputs produced and the tradable inputs used.

Primary Factors

The two primary factors considered in the context of computing the DRC for the industrial sectors are labour and capital. Each will be discussed separately.

Labour

It is well known that labour is not a homogeneous factor of production. For the purpose of this study, labour was classified into four broad categories, namely, unskilled, semi-skilled, skilled and professional, and a sample survey was used to ascertain the skill mix of each enterprise interviewed. In 1973, the Bureau of Manpower conducted a complete survey of all the industrial establishments in Bangladesh. The survey report (hereafter referred to as BMPS) gives a detailed break-down of the number of employees engaged at two digit level of industrial classification by individual occupations together with the minimum and maximum remuneration of each occupation. On the basis of this list, the occupations were classified into the four skill categories mentioned above. It was learnt in the course of the survey that overwhelming proportion of the training required for the unskilled workers to become semi-skilled or skilled occurs on the job, the shadow wage cost for these workers was computed by adding the social cost of this training to the shadow wage rate of the unskilled workers.[3]

However, it needs to be recognized that within a broad skill category there may be substantial inter-sectoral differences in the skill content. It has been assumed that the divergence of the wage rate paid by any sector for a skill category from the

[1]The value of α in this study is 2.07, which is taken from [3].

[2]The shadow prices used in this study are based on [3].

[3]For details regarding computation of social cost of training see [6].

average wage rate of the same category across the whole manufacturing sector reflects such differences. So, the average annualized training cost was multiplied by $w_i/\bar{w}$ where w_i is the wage rate paid by the sector and $\bar{w}$ is the average wage rate for the concerned skill category, to obtain the training cost of each sector,[4] and this was added to the shadow price of the unskilled labour, to obtain the sectoral shadow price of the semi-skilled and the skilled labour. The result of this procedure is a vector of the sector-specific shadow costs for the semi-skilled and the skilled worker for use in the DRC estimates. For the professional category, the market wage was used as the shadow cost.

Fixed Capital

Estimating the shadow cost of fixed capital involves thorny problems. Four alternative approaches to the estimation of the fixed capital costs were tried, and three proved to be operationally feasible and permitted the testing for the stability of the DRC ranking to errors in measurement of this input. The various approaches are discussed below.

(i) The first consists of taking the book values of capital stock, multiplying it by the shadow price of capital, and annualizing it to obtain the annual shadow cost of capital. (In the system of shadow pricing used, the shadow price of capital is a present value concept and not an internal rate of return.)

The annual shadow cost of capital was derived by using the following formula :

$$K_jPK = \frac{x_j}{(1+ STP)} + \frac{x_j}{(1+STP)^2} + \ldots\ldots \frac{x_j}{(1+STP)^{\infty}}$$

where x_j = the annual shadow capital cost for sector j ;

K_j = the capital stock in the j^{th} sector (obtained from firm data) ;

PK = the shadow price of capital stock ; and

STP = the social time preference.

The values used for PK and STP are 1.17 and .06 respectively [3].

[4] This implies that if the wage rate of a skill category in a particular sector is 20% higher than the average wage rate for that category, the social cost of training of labour of that skill category for that sector would be considered to be 20% higher than the average social cost in estimating the shadow price.

This approach is by no means satisfactory since what is of interest is the replacement cost of physical capital stock. There are a number of reasons why the book values will be a poor guide to the estimation of the replacement cost :

(a) Assets are entered into the books at the current prices of the year of purchase whereas the prices of capital goods in general have been rising. Then the book values will underestimate replacement costs on this account.

(b) Depreciation allowances, as determined by the tax laws, are much greater than the actual physical deterioration of the capital stock. Again an underestimate will result.

(c) The purchase prices entered into books may be over-statements of the actual cost at the prices of the relevant year as a result of the existence of a scarcity premium on the foreign exchange and the fact that it was generally easier during the Pakistan times, when most of the sample firms came into existence, to obtain a foreign exchange allocation for the new investment, than to obtain foreign exchange for other purposes. Hence, the imported component of the investment goods may well suffer from over-invoicing.

There is no reason to believe that these biases will cancel each other out. Nevertheless the book values have been used to calculate one set of the DRC estimates.

(ii) Secondly, the project survey included the question : "If you were to sell this plant today, how much would you receive for it ?" The responses to this question provide one set of estimates of the replacement cost. The accuracy of the responses to this kind of question is hard to assess. Nonetheless, the responses do provide at least an intelligent guestimate of the replacement cost.

(iii) Thirdly, the following question was asked : "If you were to rebuild your plant as it is, how much would you have to pay for the fixed capital costs ?" Here again the responses cannot be considered to be accurate. In principle, if the market for the used capital goods functions perfectly, then the sale price and the purchase price should be identical. But a difference may arise from the fact that no equipment, in exactly the same physical condition as that owned by the firm, may perhaps be available for purchase, and also because the respondents have probably answered in terms of the purchase of a comparable, but not excatly an identical, stock. In any case, responses to this question also provide a plausible estimate of the replacement cost and have been used to estimate a set of the DRCs.

(iv) Fourthly, it was also attempted to estimate the replacement cost more directly, but without any success. The survey questionaire divided the fixed capital stock into five categories : land, buildings, machinery, transport equipment and

other fixed assets. Investment in each year (in Taka) in each of these categories since inception was asked of each firm. Even a cursory examination revealed such gross understatement of the investment figures that the available information was not judged even worthy of coding.

Intermediate Inputs

The survey generated information on six broad categories of intermediate inputs: (a) Direct production materials, (b) Energy and water, (c) Packaging materials, (d) Repairs and maintenance, (e) Material inputs for auxiliary facilities and (f) Non-factor service inputs (e.g. , insurance, advertising, banking services). The first two types of input are quantitatively important. The remaining categories of inputs constitute a small proportion of the total intermediate inputs.

Direct Production Materials

Quantitatively this is the dominant category among the intermediate inputs. These have been treated as tradable inputs and evaluated at world prices.

Energy and Water

This category of inputs consists mainly of electricity, gas and water. However, there also exists some use of the tradable energy inputs, mainly coal and oil. Wherever a tradable energy input has been reported, it has been valued at world prices. The remainder has been treated as non-tradables and is discussed separately.

Packaging Materials

These have been considered as tradable inputs and valued at world prices. However, in quite a few cases, the firms did not report individual items. From the perusal of firm data, which contains a detailed breakdown, it appears that the most commonly used packaging materials are wooden cases, tin containers, paper board, packing paper, polyethylene bags, hessian and sacking. For firms which reported a lump sum value of packaging material, a simple average[5] tariff rate of 95% (based on the rates applicable to the afore-mentioned items) and the standard sales tax rate (20%) have been used to obtain the world priced value.

Repairs and Maintenance

It is desirable to treat repairs and maintenance as nontradable. But there does not exist a corresponding sector in the I-0 table for Bangladesh. It has not, therefore, been possible to decompose this item into value added and tradable inputs. It has arbitrarily been assumed that 50% of the reported value is foreign exchange and the remainder is value added by the semi-skilled labour. The latter has been

[5]The simple average has been used because divergence in tariff rates of these items is not very large.

shadow priced and included in the numerator, while the foreign exchange component has been subtracted from the denominator.

Material Inputs for Auxiliary Facilities (e.g., Office Supplies)

Almost all firms have reported lump sum values for this category. The component items have been regarded as tradable and, to derive the world priced values, use has been made of a tariff rate of 100% based on a simple average (for the same reason as in the case of packaging material) of writing paper, carbon paper and writing ink plus the standard sales tax rate.

Non-factor Service Inputs (Advertisement, Insurance)

This category has been treated as non-tradable.

Non-tradables

Non-tradable inputs referred to above have all been decomposed into their constituents of the direct and the indirect value added (i.e., the professional labour, the skilled labour, the unskilled labour and capital) as well as the direct and the indirect tradable inputs, so that the value added components valued at their respective shadow prices can be added in the numerator and the tradable inputs valued at their world prices can be subtracted from the denominator of the respective DRC.

World Prices

An essential step in estimating the DRC is to obtain the international prices[6] for the outputs produced or the inputs used. Regarding the latter, an effort was made to obtain the c.i.f. prices directly from the firm surveys. The effort did not prove very rewarding for a number of reasons. To the extent the firms bought their inputs from the Trading Corporation of Bangladesh or from the commerical importers, they simply did not know the exact c.i.f. prices. They are, of course, expected to know the c.i.f. prices of inputs imported under direct license. In some cases, the firms did indicate these prices ; in others, they did not, for whatever reasons. As regards outputs, the firms were not asked to report the c.i.f. prices for the comparable imported products. It was assumed that the firms either would not know, or even if they did, they would be unwilling to divulge the differential between their prices and the prices of comparable imported products. It was necessary, therefore, to rely on alternative sources of information to obtain the international prices. The principal sources of information were the following :

(i) The Bureau of Statistics has complied quantities and values of commodities at the seven-digit international trade classification level by countries of import/export from which the unit prices were calculated. Other publications of the

6 The terms "international price" and "world price" have been used interchangeably throughout this study.

Bureau like Monthly Statistical Bulletins and Economic Indications of Bangladesh were also consulted.

(ii) Prior to the preparation of the import policy, various government agencies and sector corporations report the c.i.f. price of major items to the Commerce Ministry to back up their demand for the foreign exchange allocation. Access to these records was obtained.

(iii) After an initial round of examination of the above sources, the Collector of Customs was furnished with a list of the missing prices. He was good enough to supply some of these.

(iv) The missing list was also furnished to a Chamber of Commerce and a private trading house. No response could be secured from the former, but the latter provided a few prices.

In spite of the efforts indicated above, it was not possible to secure the international prices of all the outputs and the inputs.

Parallelly, the international prices were estimated on the basis of both the domestic values obtained in the sample survey and the known facts about the import regime, the tariffs, the wage earner's premium and the sales tax on the imports. Where there was an observed international price, the estimated world price was compared to the observed world price as a consistency check. Finally, a determination was made in all cases where it seemed desirable to deviate from the general principle of using the observed world prices.

IV. FINDINGS AND ANALYSIS

A number of different DRC indicators for sixty five[7] industrial sectors of Bangladesh have been estimated. The set of results discussed in this chapter is shown in the Appendix Tables C-1 and C-2 . These sets contain the following versions of the DRCs :

DDRCS = the short-run DRC with the observed input ;

DDRCLA = the long-run DRC with the observed input and an average of the sales and the replacement values as the measure of the capital input;

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[7]The appendices record 69 sectors because the computer programme was prepared on the basis of the original sample classification of the sector . But there was no response from sectors 17, 19, 51 and 55. Furthermore, sectors 2, 64 and 65 are really non-tradables. No meaning should be attached to the DRC numbers found against these sectors.

DDRCLB = the long-run DRC with the observed input and the book value as the measure of the capital stock ;

DDRCLC = the long-run DRC with the observed input and the sale value as the measure of the capital stock ;

DDRCLD = the long-run DRC with the observed input and the replacement value as the measure of the capital stock.

Corresponding to these measures, there is another set of five measures (denoted by DDCCS, DDRCCA, DDRCCB, DDRCCC and DDRCCD respectively) where a 10% correction has been made on the value of inputs.[8]

The short-run versions measure the marginal cost of earning a dollar on the existing capital stock. That is, the fixed capial cost has been completely ignored. The long-run versions are based on capacity expansion at the historical levels of utilization but have used different measures of the capital input. The short-run as well as the long-run measures are also distinguished on the basis of whether the observed inputs are used for the estimation or a correction factor of 10% is applied.

Out of the above solutions, the DDRCS (the short-run with the observed input) and the DDRCLA (the long-run with the observed input and average of the sales and the replacement values as the measure of the capital input) have been accepted as base line solution.

Findings

(a) Negative DRCs

One of the features which deserves special attention is that there is a large number of sectors with negative DRCs. This result is of considerable concern, for a negative DRC implies a waste of the foreign exchange ; the same level of product availability would be maintained and, in addition, some free foreign exchange would be available, if the domestic production sector were shut down and the output imported instead. As can be seen in Appendix Table B, the negative DRCs appear in all the variants, whether the short run or the long run. Moreover, there are the same number of sectors apparently wasting foreign exchange in each variant and they are precisely the same sectors. This is necessarily so by construction, since exactly the same input coefficients are used for all the indicators in so far as the traded inputs are concerned and thus the negative DRCs result from the denominator of the indices in which the free foreign exchange earnings are negative.

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[8]Such correction of the inputs means that the input cost has been reduced by 10% on the assumption that there exists a wide-spread over-reporting of the inputs. In the course of the survey work, it was learned from a Government statistician that the magnitude of such over-reporting is likely to be of the order of 10%.

Counting the number of the sectors which have negative denominators, it is found that these are 18 out of a total of 62 sectors, i.e., 29%. Moreover, they include one rather important sector, the cigarettes (sector 5), as well as some potentially important ones, such as the narrow fabrics (sector 13), the various metalworking sectors (36, 41, 42), the ceramics (sector 60) and the various electrical goods (sector 62).

A number of possible explanations exist for the finding described above :

(i) The sectors involved may simply be inefficient in the material usage compared to the world standards and thus they may in fact waste foreign exchange. Some indication of the micro efficiency (at the market prices) of the sectors can be derived from looking at their financial profits as has been done in Appendix Table B. It will be noticed that 6 out of 18 sectors (33%) with negative denominators also show financial losses. However, it should be pointed out that there is no direct relationship between the financial losses and the negative foreign exchange earnings, since the financial losses may well be caused by overstaffing or by price controls rather than by inefficiency in the use of the material inputs.

(ii) The negative foreign exchange earnings may be the result of a mistaken estimation of the world prices. To the extent that no observed world prices were available, this estimation has been accomplished by deflating the domestically observed values by means of the import regime and the sales taxation. If there was water in the tariff, the value of the output has been underestimated thus reducing the foreign exchange income and turning the denominator negative. To the extent that this cause is of major importance, the finding of the negative DRCs may be a construct rather than a reality. However, this problem is likely to be more serious for the products subject to price control. For most of these items, the observed world prices have been used. The cigarettes remain a notable exception.

(iii) The input coefficients recorded in the sample survey may incorporate a reporting distortion in the form of an overstatement of the required inputs. Indeed, there is a fairly widespread belief that it is common to overstate the input requirements. The private entrepreneurs may do so in order to generate an over-invoicing of the imports and then to repatriate the difference through the WES market to realize the WES premium over the official exchange rate. The motive, in the case of the public sector enterprises, may be to resell the excess inputs and divert the revenue to private pockets.

Reducing the reported input requirement by 10% makes 4 out of 18 negative DRC sectors turn positive, as can be noticed in Appendix Table B. It is noteworthy that among these sectors are included edible oils and miscellaneous electrical goods.

(b) Sectors with Comparative Advantage

According to DRC values in Appendix C-1, Bangladesh has a comparative advantage in short-run in 36 sectors and in the long-run in 36 (DDRCLB), or 27 (DDRCLC, DDRCLD and DDRCLA) sectors, depending on the valuation of the capital input one chooses.

The sectors in which Bangladesh is found to enjoy comparative advantage can be broadly grouped as under:

(i) Based on the indigenous raw materials : sectors such as 4 (tea blending), 6 (footwear except rubber footwear), 11 (jute manufactures), 22 (tanning and leather finishing), 23 (leather products other than footwear) and 66 (sugar) belong to this group.

(ii) Sectors in which LDCs are generally expected to have comparative advantage : In this category one could include sectors like 7 (umbrella), 8 (ready-made garments), 9 (cotton textiles), 16 (threads) and 44 (bicycles).

(iii) Sectors for which no self-evident justification exists : this category comprises of sectors like 45 (textile machinery), 46 (printing trade machinery), 57 (pumps) and a few others. It is to be noted that all these sectors enjoy a relatively low protection and consequently have to be efficient to compete successfully with the substitutive imports. It is also to be noted that the products are of a relatively simple nature and that the capital-output ratio is also not very high.

(c) Sectors with a Positive DRC but a Lack of Comparative Advantage

Leaving aside the sectors with negative DRCs, Bangladesh seems not to have comparative advantage according to the DRC values at Appendix C-1 in 10 sectors in the short-run and in 10 or 19 sectors in the long-run depending on the measure of the capital input. These sectors either have a high degree of protection and could, therefore, be conceivably inefficient or demonstrate a high degree of capital intensity. The latter group includes sectors like 20 (paper), 30 (matches) and 32 (steel). As regards the paper and the matches, other studies have also found them to be highly capital intensive [4 ; 7]. The sectors with a high protection include 15 (textile NEC), 21 (articles of pulp and paper), 34 (glass products), 38 (stainless steel cutlery) and 48 (radio, refrigerator, air-conditioner).

Difficulties with the data have their impact on the findings regarding sectors with comparative advantage and disadvantage. Two issues are of particular importance:

(i) The reporting distortion potentially can make a substantial difference. However, an adjustment for an overstatement of input by 10%, raises the total number of sectors in which Bangladesh has comparative advantage to 41 (DDRCCS),

39 (DDRCCB), 34 (DDRCCC), 32 (DDRCCD) and 33 (DDRCCA) depending on the time frame and the indicator used. Contrasted with DRC estimates based on observed inputs a maximum of seven sectors switch from comparative disadvantage to comparative advantage.

(ii) The capital co-efficient estimation may also have considerable impact. Here again it is found that, leaving aside the estimates based on book value, only two sectors switch in respect of comparative advantage grouping within any given input version.

Sensitivity to Shadow Prices

We have tried to test the stability of the comparative advantage grouping by a parametric variation in the set of the base line shadow prices. In addition to the base line solution, four other sets of shadow prices were used to estimate DRCs. In recogaition of the interdependence of all the shadow prices, it has been ensured that the shadow price values within each set are mutually compatible. The sets of shadow prices used have been taken from [3] and are reproduced in the following table :

TABLE I

SETS OF SHADOW PRICES

Version	STP	α	B	PK	PL/W	$\frac{PL/W}{PK}$
Base Line	.06	2.07	1.22	1.17	.30	.26
I	.04	2.20	1.21	1.79	.30	.17
II	.06	2.11	1.27	1.21	.20	.17
III	.06	2.02	1.18	1.12	.40	.36
IV	.06	1.90	1.24	.40	.30	.75

STP= The social time preference ;

α= The multiplier to convert the official exchange rate into the shadow exchange rate ;

B= The correction factor to transform the private rate of return into the social rate of return ;

PK= The shadow price of the capital ; and

PL/W= The ratio of the shadow to the market wage rate.

It will be noticed that the sets of the shadow price have been so chosen as to obtain a considerable range of variation in relative shadow prices compared to the base line

set. In spite of this variation, it is found that there are only two sectors, 18 (wood furniture) and 54 (industrial chemicals), which switch in the short-run. Five sectors switch in the long-run ; and these are 12 (silk and art silk), 24 (plastic products), 29 (acids and alkalides), 33 (manufacture of glass) and 39 (hand and edge tools).

V. IMPLICATIONS AND CONCLUSION

As already noted, too many sectors appear to waste rather than save foreign exchange. The policy implication that these should be shut down cannot perhaps be accepted without a further exploration of the situation, particularly keeping in view the data limitations with respect to the world prices. It is, however, very unlikely that with any fine tuning of the data, these sectors will show comparative advantage. There is only one sector (68 : tobacco manufactures NEC) which switches so much as to show the short-run comparative advantage with the input correction though its long-run DRC still remains more than 100% above the cut off value. As can be seen in Appendix Table B, very few sectors with negative DRCs turn positive even with input correction. Taking the basic long-run solution as the point of reference, only four sectors with positive DRC switch to comparative advantage (sectors 29, 33, 39, 53) with a 10% reduction of the inputs, but all sectors reported an input intensity lower than the modal intensity. Similarly, within any given input version, only two sectors switch with different measures of the capital input (excluding the book value measure).[9] A logical deduction that seems to emerge is that the results of this study may not provide any conclusive evidence for comparative advantage ranking, but they do provide dependable indicators for identifying areas of comparative advantage or disadvantage.

In view of discussions above, it can be concluded that the results of this study are not very sensitive to the plausible errors of the data measurement and consequently provide dependable indicators of comparative advantage grouping.

A summary view of the findings of this study on the basis of discussions in this section is presented in the Appendix Table A in which 'P' means that it is socially profitable for Bangladesh to continue production in the sector. If 'P' occurs in the short-run, but not in the long-run, that implies that production is socially profitable only with the existing capacity ; no expansion of capacity should take place, that is, new investment should not be allowed to take place in these areas. 'I' means that Bangladesh does not have comparative advantage in that sector and so, should import the products of that sector. 'U' indicates that it is unclear from the available data as to whether production should continue in that sector or not. Additional research in these areas is required.

[9]It is also observed that very few sectors switch from comparative advantage to disadvantage in spite of substantial variation in shadow prices.

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Appendix

TABLE A

SUMMARY VIEW OF FINDINGS

Sector No.	Descriptive Title	Short-run	Long-run
1	Fruit canning ..	I	I
3	Edible oils and fats ..	I	I
4	Tea blending ..	P	P
5	Cigarettes ..	U	U
6	Footwear except rubber ..	P	P
7	Umbrella ..	P	P
8	Readymade garments ..	P	P
9	Cotton textile ..	P	P
10	Woolen textile ..	I	I
11	Jute manufactures ..	P	P
12	Silk and art silk ..	P	P
13	Narrow fabric ..	I	I
14	Knitting hosiery ..	I	I
15	Textile NEC ..	P	I
16	Thread ..	P	P
18	Wood furniture ..	U	U
20	Paper and pulp ..	I	I
21	Articles of pulp and paper ..	P	I
22	Tanning and leather finishing	P	P
23	Leather products (suit cases, bags)	P	P
24	Plastic/Synthetic products ..	U	U
25	Paints and vernish ..	P	P
26	Boot polish ..	P	P
27	Perfumes/Cosmetics ..	I	I
28	Soap (also includes some cosmetics)	I	I
29	Acids, alkalides ..	P	I
30	Matches ..	P	I
31	Disinfectants ..	P	P
32	Iron and steel ..	P	I
33	Manufacture of glass (Glass sheets)	P	I
34	Glass products ..	I	I
35	Cement ..	P	P
36	Metal products ..	I	I
37	Heating equipment (Kerosene Cooker)	P	P
38	Stainless steel cutlery ..	I	I
39	Hand and edge tools (Shovel, spade etc.)	P	I
40	Hardware .. (Tower bolts, door hinges etc.)	I	I
41	Utensils ..	I	I
42	Metals, barrels ..	I	I
43	Bolts (Rivets, wire nail etc.)	I	I
44	Bicycles ..	P	P
45	Textile machinery ..	P	P
46	Printing machinery ..	P	P
47	Electric fans ..	P	P
48	Communication equipment (Radio, refrigerator etc.)	I	I

(Contd.)

TABLE A (Contd.)

Sector No.	Descriptive Title	Short-run	Long-run
49	Plastic products .. (Pen holders, name plates etc.)	I	I
50	Pens and pencils ..	I	I
52	Sewing machines ..	I	I
53	Electric fans ..	I	I
54	Industrial chemicals ..	I	I
56	Industrial machinery ..	U	U
57	Pumps ..	P	P
58	Fire extinguishers ..	P	P
59	Coal tar ..	I	I
60	Ceramics ..	I	I
61	Agricultural machinery .. (Drill machine, diesel pump)	P	P
62	Miscellaneous electrical goods (Generator, transformer etc.)	I	I
63	Rubber footwear ..	P	P
66	Sugar ..	P	P
67	Distillery ..	U	U
68	Tobacco manufactures NEC ..	U	I
69	Ship building ..	I	I

TABLE B

SECTORS WITH NEGATIVE DDRC

Sector	Descriptive Title	DDRCS*	DDRCLA	DDRCLB	DDRCLC	DDRCLD	Financial Losses	DDRC Turns Positive with Correction
1	Fruit canning	−0.94	−1.35	−1.02	−1.30	−1.40	YES	NO
3	Edible oils	−9.08	−10.61	−9.33	−10.41	−10.80	YES	YES
5	Cigarettes	−0.93	−1.27	−1.01	−1.24	−1.30	NO	NO
10	Woolen textile	−3.66	−5.06	−4.33	−4.85	−5.28	NO	NO
13	Narrow fabric	−3.18	−4.08	−3.34	−3.98	−4.17	NO	YES
14	Knitting hosiery	−0.55	−0.87	−0.59	−0.82	−0.92	NO	NO
27	Perfumes, cosmetics	−16.32	−16.75	−16.45	−16.71	−16.79	NO	NO
28	Soap	−1.17	−1.60	−1.23	−1.48	−1.72	NO	NO
36	Metal products	−1.28	−2.04	−1.54	−1.97	−2.11	NO	NO
41	Utensils	−0.21	−0.36	−0.26	−0.36	−0.37	NO	NO
42	Metals, barrels	0.57	−4.72	−1.25	−4.46	−4.98	YES	NO
43	Bolts	−1.60	−4.94	−2.03	−4.48	−5.40	YES	NO
49	Plastic products	−0.83	−1.31	−0.93	−1.27	−1.34	NO	NO
59	Coal tar	−0.52	−0.66	−0.54	−0.65	−0.67	NO	NO
60	Ceramic products	−0.83	−1.24	−0.96	−1.19	−1.29	YES	NO
62	Misc. electrical goods	−2.17	−3.99	−2.84	−3.82	−4.16	NO	YES
68	Tobacco manufacture NEC	−0.34	−1.84	−0.47	−1.81	−1.86	NO	YES
69	Ship building	−1.17	−1.77	−1.29	−1.72	−1.82	YES	NO

*DDRCS=short-run domestic resource cost (excluding capital input) ; DDRCLA=long-run domestic resource cost (capital cost based on average of sale and replacement value) ; DDRCLB=long-run domestic resource cost (capital cost based on book value); DDRCLC=long-run domestic resource cost (capital cost based on sale value) and DDRCLD=long-run domestic resource cost (capital cost based on replacement value)

TABLE C-1
SHORT-RUN AND LONG-RUN DDRC AND ERP (Survey Inputs)

No.	Description of Sector	DDRCS	DDRCLA	DDRCLB	DDRCLC	DDRCLD	ERP*
1	Fruit canning	—0.96	—1.35	—1.02	—1.30	—1.40	0.0035
2	Milling	—43.08	—43.08	—43.08	—43.08	—43.08	47.36
3	Edible oils/fats	—9.08	—10.61	—9.33	10.41	—10.80	—6.50
4	Tea blending	0.89	0.99	0.90	0.98	1.00	—0.14
5	Cigarettes	—0.93	—1.27	—1.01	—1.24	—1.30	—2.09
6	Footwear except rubber footwear	0.26	0.34	0.27	0.32	0.35	—0.46
7	Umbrella	0.33	0.52	0.35	0.48	0.56	—0.41
8	Readymade garments	0.35	0.55	0.39	0.53	0.58	—0.27
9	Cotton textile	0.42	0.64	0.44	0.60	0.67	—0.50
10	Woolen textile	—3.66	—5.06	—4.33	—4.85	—5.28	—5.50
11	Jute textile	1.36	1.77	1.41	1.71	1.84	0.38
12	Silk and art silk	1.30	2.42	1.60	2.13	2.71	—0.26
13	Narrow fabric	—3.18	—4.08	—3.34	—3.98	—4.17	—7.53
14	Knitting hosiery	—0.55	—0.87	—0.59	—0.82	—0.92	—2.67
15	Textile NEC	1.46	3.70	1.62	3.40	4.00	3.90
16	Thread	0.58	1.00	0.62	1.00	1.00	0.67
17	Plywood	0.00	0.00	0.00	0.00	0.00	0.00
18	Wood furniture	2.12	4.14	2.39	4.03	4.26	3.53
19	Metal furniture	0.00	0.00	0.00	0.00	0.00	0.00
20	Paper, pulp	13.70	27.62	18.20	27.57	27.68	—8.64
21	Articles of pulp and paper	1.80	4.02	2.04	3.96	4.09	—0.10
22	Tanning and leather finishing	0.51	0.77	0.54	0.75	0.79	—0.18
23	Leather products	0.79	0.95	0.81	0.94	0.96	—0.38
24	Plastic products/Synthetic	1.65	2.17	1.81	2.11	2.24	2.10
25	Paint, varnish	0.92	1.13	0.94	1.09	1.17	0.09
26	Polish	0.98	1.29	1.10	1.24	1.35	—1.75
27	Perfumes, cosmetics	—16.32	—16.65	—16.45	—16.71	—16.79	—3.38
28	Soap	—1.17	—1.60	—1.23	—1.48	—1.72	—3.25
29	Acids, alkalides	1.60	2.13	1.70	2.08	2.18	—0.21
30	Matches	1.28	4.14	1.70	3.82	4.46	1.16
31	Disinfectants	0.30	0.51	0.34	0.49	0.53	1.13
32	Iron and steel	1.24	5.59	1.74	5.60	5.58	0.64
33	Manufacture of glass	1.03	2.40	1.18	2.27	2.53	—0.05
34	Glass products	6.16	6.39	6.22	6.35	6.44	18.24
35	Cement	0.27	0.65	0.33	0.62	0.68	—0.94

*ERP=effective rate of protection ; for other symbols, see Table B.

(Contd.)

TABLE C-1 (Contd.)

No.	Description of Sector	DDRCS*	DDRCLA	DDRCLB	DDRCLC	DDRCLD	ERP
36	Metal products	—1.28	—2.04	—1.54	—1.97	—2.11	—4.14
37	Heating equipment	0.72	1.08	0.76	1.06	1.10	0.08
38	Cutlery (stainless steel)	8.16	10.79	8.94	10.73	10.85	3.87
39	Hand and edge tools	1.37	2.40	1.56	2.25	2.57	1.56
40	Hardware	4.04	6.87	5.15	6.41	7.33	5.06
41	Utensils	—0.21	—0.36	—0.26	—0.36	—0.37	—1.68
42	Metals, barrels	—0.57	—4.72	—1.25	—4.46	—4.98	—1.50
43	Bolts	—1.60	—4.94	—2.03	—4.48	—5.40	—1.39
44	Bicycles	0.51	0.70	0.54	0.68	0.73	—0.23
45	Textile machinery	1.05	1.26	1.07	1.25	1.27	—0.45
46	Printing machinery	0.26	0.60	0.28	0.55	0.64	0.16
47	Electric lamps	0.88	1.73	1.20	1.58	1.87	2.95
48	Communication equipment	4.88	9.94	5.93	9.49	10.40	12.94
49	Plastic products	—0.83	—1.31	—0.93	—1.27	—1.34	—3.80
50	Pens and pencils	10.87	16.66	11.31	16.27	17.06	18.89
51	Toothbrush	0.00	0.00	0.00	0.00	0.00	0.00
52	Hand machines (sewing machines)	3.24	4.07	3.30	3.99	4.15	3.90
53	Electric fans	2.49	3.11	2.62	3.08	3.14	4.02
54	Industrial chemicals	2.16	3.41	2.85	3.25	3.57	2.50
55	Safes (lockers)	0.00	0.00	0.00	0.00	0.00	0.00
56	Industrial machinery	0.59	0.96	0.62	0.93	0.99	.65
57	Pumps	0.44	0.53	0.46	0.51	0.55	0.28
58	Fire extinguishers	1.27	1.84	1.35	1.81	1.87	—0.21
59	Coal tar	—0.52	—0.66	—0.54	—0.65	—0.67	—1.40
60	Ceramic products	—0.83	—1.24	—0.96	—1.19	—1.29	—1.20
61	Agricultural machinery	0.39	0.90	0.44	0.90	0.90	0.19
62	Miscellaneous electrical goods	—2.17	—3.99	—2.84	—3.82	—4.16	—11.79
63	Rubber footwear	0.72	0.90	0.76	0.85	0.95	—2.04
64	Dairy products	0.46	0.84	0.93	0.82	0.87	—0.26
65	Fish export	0.54	0.71	0.58	0.70	0.72	—0.13
66	Sugar	0.38	0.53	0.42	0.51	0.55	—0.69
67	Distillery	0.18	0.22	0.18	0.21	0.24	1.68
68	Tobacco manufacture, NEC	—0.34	—1.48	—0.47	—1.81	—1.86	—10.22
69	Ship building	—1.17	—1.77	—1.29	—1.72	—1.82	—1.32

*DDRCS=short-run domestic resource cost (excluding capital input) ; DDRCLA=long-run domestic resource cost (capital cost based on average of sale and replacement value) ; DDRCLB=long-run domestic resource cost (capital cost based on book value) ; DDRCLC=long-run domestic resource cost (capital cost based on sale value) and DDRCLD=long-run domestic resource cost (capital cost based on replacement value).

TABLE C-2

DDRC WITH ADJUSTED INPUTS

No.	Descriptive Title	DDRCCS	DDRCCA	DDRCCB	DDRCCC	DDRED
1	Fruit canning	—1.32	—1.92	—1.43	—1.85	—1.99
2	Milling	—49.27	—49.27	—49.27	—49.27	—49.27
3	Edible oils fats	1.71	2.01	1.76	1.97	2.04
4	Tea blending	0.45	0.51	0.46	0.51	0.51
5	Cigarettes	—1.58	—2.17	—1.73	—2.11	2.22
6	Footwear except rubber footwear	0.22	0.29	0.23	0.28	0.30
7	Umbrella	0.28	0.43	0.29	0.40	0.47
8	Readymade garments	0.32	0.51	0.36	0.49	0.53
9	Cotton textile	0.37	0.56	0.39	0.53	0.59
10	Woolen textile	—25.13	—34.89	—29.83	—33.41	—36.37
11	Jute textile	0.90	1.19	0.94	1.14	1.23
12	Silk and art silk	1.10	2.11	1.37	1.85	2.38
13	Narrow fabric	37.32	48.04	39.27	46.90	49.17
14	Knitting hosiery	—0.77	—1.24	—0.84	—1.16	—1.31
15	Textile NEC	1.07	2.78	1.19	2.55	3.00
16	Thread	0.53	0.92	0.57	0.92	0.92
17	Plywood	0.00	0.00	0.00	0.00	0.00
18	Wood furniture	1.75	3.42	1.97	3.32	3.51
19	Metal furniture	0.00	0.00	0.00	0.00	0.00
20	Paper, pulp	4.64	9.56	6.23	9.55	9.58
21	Articles of pulp and paper	1.25	2.84	1.42	2.79	2.88
22	Tanning and leather finishing	0.31	0.47	0.33	0.46	0.48
23	Leather products	0.64	0.76	0.65	0.75	0.77

(Contd.)

TABLE C-2 (Contd.)

No.	Descriptive Title	DDRCCS	DDRCCA	DDRCCB	DDRCCC	DDRCCD
24	Plastic products/Synthetic	1.33	1.76	1.47	1.71	1.82
25	Paint, varnish	0.78	0.97	0.80	0.94	1.00
26	Polish	0.77	1.02	0.86	0.98	1.07
27	Perfumes, cosmetics	—41.78	—42.89	—42.11	—42.79	—43.00
28	Soap	—2.73	—3.77	—2.88	—3.29	—4.05
29	Acids, alkalides	1.39	1.86	1.48	1.82	1.90
30	Matches	1.06	3.52	1.42	3.26	3.80
31	Disinfectants	0.27	0.48	0.32	0.46	0.49
32	Iron and steel	0.86	3.99	1.21	4.00	3.99
33	Manufacture of glass	0.80	1.91	0.93	1.81	2.02
34	Glass products	2.21	2.30	2.23	2.28	2.32
35	Cement	0.21	0.53	0.26	0.51	0.55
36	Metal products	—4.43	—7.05	—5.30	—6.45	—7.29
37	Heating equipment	0.63	0.95	0.66	0.93	0.97
38	Cutlery (stainless steel)	4.84	6.48	5.33	6.45	6.52
39	Hand and edge tools	1.18	2.07	1.34	1.92	2.22
40	Hardware	2.54	4.34	3.25	4.05	4.63
41	Utensils	—0.27	—0.46	—0.33	—0.45	—0.47
42	Metals, barrels	—0.81	—7.30	—1.87	—6.89	—7.71
43	Bolts	—4.16	—13.12	—5.32	—11.88	—14.35
44	Bicycles	0.42	0.58	0.44	0.56	0.60
45	Textile machinery	0.74	0.88	0.75	0.88	0.89
46	Printing machinery	0.24	0.57	0.26	0.52	0.61
47	Electric lamps	0.68	1.34	0.93	1.23	1.46
48	Communication equipment	2.45	5.02	2.98	4.79	5.25
49	Plastic products	—1.94	—3.06	—2.18	—2.98	—3.14

(Contd.)

TABLE C-2

(*Contd.*)

No.	Descriptive Title	DDRCCS*	DDRCCA	DDRCCB	DDRCCC	DDRCCD
50	Pens and pencils	3.11	4.79	3.24	4.68	4.91
51	Toothbrush	0.00	0.00	0.00	0.00	0.00
52	Hand machines (sewing machines)	2.22	2.79	2.26	2.73	2.84
53	Electric fans	1.57	1.99	1.66	1.97	2.01
54	Industrial chemicals	1.52	2.43	2.02	2.31	2.54
55	Safes (lockers)	0.00	0.00	0.00	0.00	0.00
56	Industrial machinery	0.56	0.92	0.60	0.89	0.95
57	Pumps	0.39	0.47	0.40	0.46	0.49
58	Fire extinguishers	1.02	1.51	1.09	1.48	1.54
59	Coal tar	—0.75	—0.97	—0.79	—0.95	—0.99
60	Ceramic products	—1.09	—1.67	—1.27	—1.60	—1.74
61	Agricultural machinery	0.35	0.81	0.40	0.81	0.81
62	Miscellaneous electrical goods	3.93	7.27	5.16	6.96	7.58
63	Rubber footwear	0.65	0.82	0.69	0.78	0.86
64	Dairy products	0.35	0.66	0.73	0.64	0.69
65	Fish export	0.22	0.29	0.24	0.29	0.30
66	Sugar	0.34	0.48	0.38	0.47	0.50
67	Distillery	0.16	0.20	0.16	0.19	0.22
68	Tobacco manufacture NEC	0.90	5.00	1.27	4.93	5.06
69	Ship building	—1.47	—2.23	—1.62	—2.17	—2.29

*DDRCCS=short-run domestic resource cost (excluding capital input), adjusted input ; DDRCCA=long-run domestic resource cost (capital cost based on average of sale and replacement value), adjusted input ; DDRCCB=long-run domestic resource cost (capital cost based on book value), adjusted input ; DDRCCC=long-run domestic resource cost (capital cost based on sale value), adjusted input and DDRCCD= long-run domestic resource cost (capital cost based on replacement value), adjusted input.

Fertiliser Use in Two Selected Areas of Bangladesh

by

MD. ABUL QUASEM AND MAHABUB HOSSAIN*

The pattern of utilisation of fertilisers on farms of different sizes and tenurial categories in two villages of Bangladesh is studied in this paper. It is found that although small farmers are late adopters they are not using less fertiliser per acre compared to large farmers in comparable crops. Total fertiliser use per acre is, however, higher on large farms mainly because of differences in crop-mix, i.e., the small farmers devote a smaller proportion of the area to high-yielding crops which are fertiliser-intensive. Tenurial status of a farm is not found to have a negative impact on fertiliser use. The findings indicate that the predominance of small farms in Bangladesh, and the crop-sharing system may not act a constraint to agricultural growth through expansion of this modern input provided credit is made available to poor cultivators on favourable terms to help them adopt purchased-input-intensive crops.

I. INTRODUCTION

Utilisation of chemical fertilisers expanded very rapidly over the last two decades. At the beginning of the sixties the volume of sales of fertilisers was insignificant (only 74 thousand tons in 1962/63) and its use was limited mainly to tea gardens and Seeds Multiplication Farms. By 1969/70 the volume of sales expanded to the level of 291 thousand tons, and by 1979/80 it reached the level of 900 thousand tons[7;10]. Such a phenomenal increase in the demand for fertilizers was supported by the government's policy of providing a heavy subsidy on fertilisers all through the period. The rate of subsidy was roughly 60 per cent towards the end of the sixties [9, p. 192]; since then it has been gradually reduced but still in 1977/78 the rate of subsidy was as high as 54 per cent [3, p. 27] which claimed Tk. 806 million from the government budget [11].

Since fertiliser is a purchased input and is 'non-traditional' to the cultivators of Bangladesh, the adoption and the rate of utilisation of this input may vary at the farm level. *A priori* one would expect large farmers to be early adopters and better users of fertilizers than small farmers, because (i) the small farmers have less internal

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surplus to invest on cash inputs, (ii) they have limited access to institutional credit, and (iii) as they are less educated and operate at a subsistence level they would hesitate to adopt a 'non-traditional' input, and even if they adopt they may be unable to realise its full benefits because of ignorance. Tenurial condition of a farmer may also affect utilisation of fertilisers. A share-cropper may use less fertiliser than an owner farmer if the landlord does not share the cost of this input, because the tenant pays the full cost whereas the incremental output is shared by both parties.[1]

As fertiliser is a highly subsidised and a major growth augmenting input, the differential rate of utilisation among cultivators, if it exists, would have implications for growth of agricultural production and the distribution of income. Bangladesh agriculture is dominated by small producers, and if they cannot use fertilisers, this factor will put a constraint on the growth of production. Also the benefits of fertiliser use would accrue mainly to large and medium farmers who would also benefit most from the government subsidy, and hence the distribution of income would become more unequal. In order to understand whether and to what extent this is actually happening in the countryside, an in-depth study on the pattern of utilisation of fertilisers at the farm-level and the factors influencing it, is necessary. This paper attempts to fill in some of the gaps of information in this field. Section II of the paper mentions the sources of data and describes the general characteristics of the study area and the sample farms. Section III studies the pattern of utilisation of fertilisers in relation to various factors that might affect the rate of utilisation. Section IV presents a few other relevant information obtained from the study. The summary of the findings and their implications for policy are mentioned in Section V.

II. SOURCES OF DATA AND THE CHARACTERISTICS OF THE VILLAGES

The information was collected from two villages, Chandra and Banguri, at Kaliakair thana in the district of Dacca. Topographically the villages are different. Chandra is a flood-free high land area, located in the Red-soil Tract of Bhawal region. Banguri, on the other hand, is a flood affected area. where land is continuously silted and hence the soil is of loam or clay loam type. Both villages have access to deep-tubewell irrigation which is used for growing High Yielding Varieties (HYV) of paddy during the *boro* season. Transplant *aman* is not grown at Banguri and instead Broadcast *aman* mixed with *aus* is grown there. Chandra has a very good road communication with thana headquarters and outside, whereas Banguri is an inaccessible village which is about six miles away from a metalled road. The reference period of the survey is the 1977/78 crop year.

At the time of the survey there were 142 households at Chandra and 212 at Banguri ; of them 120 and 190 respectively were cultivators. Because of lack of resour-

[1]For a theoretical debate on this issue, see [4].

ces, detailed information could not be collected from all cultivator households. For detailed study 50 households from each village were selected through a stratified random sampling method. The cultivators who used fertilizers were divided into three strata according to the size of their operational holding i.e., small (upto 2.5 acres), medium (2.51 to 5.0) and large (5.01 and above), and a proportionate random sample was selected from each stratum to make the total sample size 50 for each village. The distribution of cultivators and the number of samples selected from difrerent landholding groups are shown in the following table.

TABLE I

DISTRIBUTION OF CULTIVATORS AND SELECTED SAMPLES BY THE SIZE OF HOLDING

Size of Holdings	Chandra			Banguri		
	Number of Cultivators	Number of Cultivators Using Fertilisers	Number of Households Interviewed	Number of Cultivators	Number of Cultivators Using Fertilisers	Number of Households Interviewed
Small (upto 2.50 acres)	45 (37.5)	27	14	110 (57.9)	89	28
Medium (2.51 to 5.0 acres)	35 (29.2)	35	17	60 (31.6)	52	16
Large (5.01 & above)	40 (33.3)	40	19	20 (10.5)	18	6
All Households	120 (100.0)	102	50	190 (100.0)	159	50

Note: Figures in the brackets are percentages.

The pattern of distribution of holdings indicates that the villages represent two extreme patterns of land distribution in Bangladesh. In Chandra only 38 per cent cultivators were small holders, compared with 58 per cent in Banguri. According to the 1960 census of Agriculture about 52 per cent of cultivators were in this category in the country as a whole [1]. At the other end, the large holders were 33 per cent in Chandra and only 11 per cent in Banguri, compared with 23 per cent for Bangladesh as reported by the 1960 Agricultural Census. The average size of holding was 4.8 acres at Chandra and 2.8 acres at Banguri (see Table II). But because of higher cropping intensity and better quality of land, the per capita income is higher in Banguri, compared with Chandra. The literacy rate and the incidence of higher education is also higher in Banguri. In Banguri, only 24 per cent had more than secondary level education, whereas in Chandra about 56 per cent of the cultivators were illiterate and only two per cent had passed secondary schools.

TABLE II

GENERAL CHARACTERISTICS OF THE SAMPLES IN THE TWO VILLAGES

Characteristics	Chandra	Banguri
1. Average Size of Holding (acres)	4.84	2.83
2. Average Size of Family	7.70	6.56
3. % of Cultivators :		
(i) Illiterates	56.0	24.0
(ii) Have Upto Secondary Level Education	42.0	54.0
(iii) Passed Secondary School Certificates, and Above	2.0	22.0
4. Cropping Intensity (%)	133	178
5. Per Capita Income (Taka)*	1137	1411
6. Yield Per Acre (mds.) :		
(i) Local Paddy	14.7	18.4
(ii) HYV Paddy	37.9	57.3

Note: Income was estimated as the gross value of production minus paid-out costs of material inputs and hired labour, plus non-agricultural income.

III. THE ADOPTION AND UTILISATION OF FERTILISERS

The Rate and Experience of Adoption

About 85 per cent of the cultivators in Chandra, and about 84 per cent in Banguri reported that they used chemical fertilisers in the crop-year 1977/78. The rate of adoption was found to be positively related with the size of holdings for both the villages (see Table III). In Chandra all cultivators holding more than 2.5 acres used fertilisers, but among the small holders the proportion of users was only 60 per cent. In Banguri 80 per cent of the small holders and 90 per cent of large holders used fertilisers in that year.

The adopters were asked to report the number of years for which they had been using fertilisers. The finding is reported in Table III. About 60 per cent of cultivators in Banguri, and 50 per cent in Chandra reported using fertilisers for more than eight years. Thus, the accessibility of a village and its land-man ratio are not seen to influence the adoption of a new input. Banguri is adversely placed with regard to both these factors but still it had longer experience with fertiliser adoption,

and the current rate of adoption in this village was about the same as in Chandra. The better literacy rate and earlier availability of irrigation in Banguri presumably played a positive role in this respect. It is, however, found that in both villages higher proportion of large cultivators were early adopters, and small cultivators were late adopters.

TABLE III

EXTENT OF ADOPTION AND PERIOD OF EXPERIENCE WITH FERTILISER USE

Landholding Groups	% of Cultivators Using Fertiliser in 1977/78	% of Adopters Using Fertiliser for		
		Upto 3 Years	4 to 8 Years	More than 8 Years
Chandra				
Small	60.0	14.3	42.9	42.9
Medium	100.0	11.8	47.1	41.2
Large	100.0	5.3	31.6	63.6
All Cultivators	85.0	10.0	40.0	50.0
Banguri				
Small	80.9	17.9	39.3	46.4
Medium	86.7	nil	25.0	75.0
Large	90.0	nil	16.7	86.3
All Cultivators	83.6	8.0	32.0	60.0

Fertiliser Use by Crops

A technical factor which can influence the cultivators' decision as to how much fertiliser is to be used on a given piece of land is the yield response to incremental doses of fertiliser use. Technical studies indicate that the yield response of fertilisers varies depending on crops in which it is applied. A recent study by Badruddoza [2] found that the incremental yield from high doses of fertiliser application was very high in *boro* and in HYV *aus* and *aman,* while it was relatively low in local *aus* and *aman* paddy. The highly differential rate of response between traditional crop varieties was also found by a study of IBRD and IDA [6]. *A priori* one would then expect that a rational cultivator would use different doses depending on crops. The amount of fertiliser used per acre of land may thus depend on the crop-mix which in turn is determined not only by economic factors but also by physical factors such as level and quality of land and the access to irrigation facilities.

The amount of fertilisers used in the major crops grown in the two villages is reported in Table IV. As expected fertiliser application was high in HYV paddy and low in local paddy varieties and in jute which was also manured in Chandra. All HYV growers in both villages used fertilisers, and 100 per cent of the HYV land was fertilised. The amount of fertilisers used in this crop was about 407 lbs per acre in Banguri, and 245 lbs in Chandra. The Banguri farmers used high doses of fertilisers also on mustard ; about 91 per cent of the land under this crop was fertilised, and the amount used per acre was 212 lbs. Medium doses of fertilisers were applied in local *aus* and transplanted *aman,* while the application was very low in mixed *aus*/broadcast *aman.* For this last crop which is grown on low-lying land in Banguri, fertiliser was applied only on about 7 per cent of the land and the rate of application per acre was found to be only 8.2 lbs. The percentage of cropped land on which fertiliser was used was higher in Chandra (84%) compared to Banguri (52%) mainly because about 42 per cent of the cropped land in the latter village was under mixed *aus*-broadcast *aman.* The amount of fertiliser used per acre of cropped land was, however, higher in Banguri (117 lbs compared with 97 lbs in Chandra) because of higher doses of application in individual crops (see Table IV). The physical characteristics of land can thus be a major factor in explaining inter-farm and inter-regional variation in fertiliser application.

TABLE IV

FERTILISER APPLICATION ON MAJOR CROPS

Crops	% of Growers Using Fertilizers	% of Land Fertilised*	Amount of Fertiliser Used* (lbs per acre)	% of Area Under the Crop
Chandra				
HYV Paddy	100.0	100.0	245	15.5
Local *Aus*	80.0	79.5	72	31.8
Local Transplanted *Aman*	91.5	87.6	74	47.2
Jute	23.6	30.0	21	5.4
All Crops	100.0	83.8	97	100.0
Banguri				
HYV Paddy	100.0	100.0	407	11.0
Mixed *Aus*/Broadcast *Aman*	8.5	6.9	8	41.8
Jute	74.0	74.0	105	28.6
Mustard	86.8	90.8	212	18.8
All Crops	100.0	51.9	117	100.0

*Based on the area under a crop (owned+shared cropped).

Farm Size and Fertiliser Use

It was argued earlier that the size of a farm may influence the extent of utilisation of fertilisers. The findings of the survey on this issue are reported in Table V.[2] In Banguri, the proportion of cropped area (owned land) fertilised and the amount of fertiliser used per acre of land was found to be positively related to farm size. In Chandra small cultivators applied fertilisers in a smaller proportion of cropped land, and the amount of fertilisers used was also less compared to other groups. But in this village the medium cultivators used the highest amount of fertiliser per acre of owned cropped land, while the large cultivators used the highest amount per acre of land fertilised.

TABLE V

UTILISATION OF FERTILISERS BY SIZE OF HOLDING

Size of Holding	% of Cultivators in the Group	% of Owned Cropped Land Fertilised	Amount of Fertiliser Used Per Acre (lbs)		% of Share of Fertiliser Used
			Total Land	Fertilised Land	
Chandra					
Small	28.0	63.5	76	107	5.9 (7)
Medium	34.0	89.5	96	108	26.9 (16)
Large	38.0	75.3	86	114	67.1 (77)
Banguri					
Small	56.0	46.6	97	207	24.1 (30)
Medium	32.0	53.1	119	224	39.0 (39)
Large	12.0	55.8	134	241	36.8 (31)

The above finding, however, is mainly the result of different crop-mix in various groups of farms. In individual crops, the effect of farm size on fertiliser use was not found systematic (see Table VI). The positive size effect was found only in the case of mustard in Banguri, and in fact, in the case of local *T. aman* in Chandra the size effect was found negative, i.e., the smaller cultivators used larger amount of fertilisers per acre of land. Fisher's Two-Sample 't'-test also indicates that the size effect on fertiliser use at the crop level is neither systematic nor significant (see Appendix Table A.2). The main reason why larger farms used more fertiliser is that they devoted a larger proportion of the area to crops which are heavy consumers of fertilisers. In Banguri, the proportion of area under HYV paddy and mustard

[2]In Chandra a significant proportion of land was under tenancy. In order to dissociate the effect of tenancy on fertiliser use, the amount of fertilisers used per acre of owned land only is reported in this section. The effect of tenancy on fertiliser use is discussed below.

was 25 per cent for small farms, 33 per cent for medium farms, and 30 per cent for large farms. In Chandra, the small farms devoted only 8 per cent of owned cropped area under HYV paddy, as against 14 per cent for medium farms, and 15 per cent for large farms.

Thus, it appears from the study that the small farmers are not lesser utilisers of fertilisers in any specific crop variety. But they are using lower amount per acre of cropped land because they cannot devote the same amount of land to high-yielding crop which are heavy user of fertilisers. Because of this and the greater control over land by the large farmer, the small farmers got less benefit from increased supply of fertilisers than medium and large farmers. It can be noted from Table V that in Banguri small farmers were 56 per cent of the cultivators but they got a share of 24 per cent of total fertilisers used, while large farmers were 12 per cent but they had a share of 37 per cent. Similar was the picture at Chandra (Table V). It is implied then that the benefits of fertiliser use and the government subsidy in it are shared disproportionately by large farmers.

Tenancy and Fertiliser Use

In Banguri almost all land was owner-operated. But in Chandra about 29 per cent of the cropped area was under share-cropping. About 34 per cent of the cultivators in this village were owner operators and the remaining 66 per cent were owner-cum-tenants. There was no pure tenant. The share-croppers in this village get 50 per cent of the gross produce and they have to bear the full costs of all inputs. Under these terms one would expect that the tenants would use lower amount of purchased inputs than an owner-cultivator if he wants to maximise his profits. This section tests the validity of this hypothesis for the village under study (Chandra).

The amount of fertilisers used per acre of fertilised land by owner and tenant operators, as well as on owned and rented land under the tenant cultivators is reported in Table VII. As the size of a farm may influence the amount of fertiliser used, the findings are reported separately for different size groups of farms in order to dissociate any possible size effects. It can be noted that tenants used higher amounts of fertilisers per acre of land than owner-cultivators. The difference is highly significant for small and medium farmers, but for large farmers the difference is negligible. Similarly, it is found that owner-cum-tenants used higher doses of fertilisers on the share-cropped land compared to owned land. This pattern of utilisation was found in the case of small and medium tenants, but in the case of large-holder tenants the amount of fertiliser used per acre was lower on share cropped land than on owned land (Table VII). Thus, tenurial status of farms or of land does not seem to have a negative effect on fertiliser use except in the case of large farms. It can also be noted that tenants are better users of fertilisers as they used larger doses on their owned land compared to the owner farmers.

TABLE VI

FERTILISER APPLICATION BY CROPS AND SIZE OF HOLDING

(lbs per acre on owned land)

Crops	Size of Holding		
	Small	Medium	Large
Chandra			
HYV	239	215	217
Local *Aus*	99	80	102
Local T. *Aman*	92	91	70
Jute	19	24	20
Banguri			
Aus/ B. *Aman*	11	11	nil
HYV	431	353	477
Jute	108	98	113
Mustard	170	208	244

A comparison of fertiliser use under different tenures for the major crops also indicated that tenants did not use less fertilisers than owners. The results are reported in Table VIII. It can be noted that in HYV and local *aman* tenants used more fertilisers than owners, and in local *aus* the difference was insignificant. But among tenant farms the amount of fertiliser used was higher on share-cropped land than on owned land only in the case of HYV paddy. In the case of local paddy, tenants used more fertilisers on owned land than on share-cropped land.

The major reason why higher amount of fertiliser was used on share-cropped land is that a larger proportion of the share-cropped land was under HYV paddy compared with owned land. About 22 per cent of the share cropped land in the village was under HYV compared to only 13 per cent of owned land. For small cultivators the difference was larger ; about 28 per cent of the share-cropped land was under HYV compared to only eight per cent of owned land (see Appendix Table A.2).

An important reason, mentioned in the literature [8], why the use of inputs by tenants may not be any less than that of owner-cultivators is the insecurity of tenure and implicit pressure on the part of the land-owner to cultivate rented land more intensively.

TABLE VII

UTILISATION OF FERTILISER BY TENURIAL STATUS AND FARM SIZE

(lbs per acre of fertilised land)

Size of Holding	Tenurial Status			
	Owner Cultivator	Owner-cum-tenants		
		Owned Land	Share Cropped Land	All Land
Small	93	102	125	115
Medium ..	76	110	141	130
Large ..	102	111	82	102
All Cultivators ..	90	106	125	118
	(17)	(28)	(32)	(33)

Note : Figures within brackets are number of cases within each cell.

TABLE VIII

FERTILISER USED IN DIFFERENT CROPS BY TENURIAL STATUS

(lbs/acre of fertilised land)

Crops	Tenurial Status			
	Owner Cultivator	Owner-cum-tenants		
		Owned Land	Share Cropped Land	All Land
HYV Paddy ..	221	224	241	234
	(10)	(15)	(19)	(19)
Local *Aus* ..	(92)	93	89	91
	(10)	(22)	(15)	(15)
Local T. *Aman*	72	94	86	90
	(10)	(22)	(22)	(22)

Note : Figures within brackets are number of cases within each cell.

In the village under study the share-cropping arrangements are verbal and in that sense all tenancies are insecure. But a large proportion of the tenants was found to operate the shared in land for more than five consecutive years (about one-third of HYV paddy and a half of local T. *aman* tenancies had such long tenures), and so implicitly there was some security of tenure. It was indeed found that the longer is the period of tenure the lower is the amount of fertilisers used on the share-cropped land (see Table IX). In the case of HYV paddy the tenants who had been cultivating the land for upto two years used 278 lbs of fertilisers per acre compared to only 207 lbs for tenants having a length of tenure for six years or more.

The findings thus indicate that the subsistence pressure[3] and the fear of losing the rented-in land compel the tenants to use fertilisers more intensively. For large tenants who do not have this pressure, the tenancy effect on fertiliser use was found negative.

TABLE IX

SECURITY OF TENURE AND ITS IMPACT ON FERTILISER USE

Length of Tenure	HYV Paddy		Local T. *Aman*	
	% of Cases	Lbs of Fertiliser Used Per Acre	% of Cases	Lbs of Fertiliser Used Per Acre
Upto 2 Years	44.4	278	20.8	102
3 to 5 Years	22.2	266	29.2	85
6 Years and Above	33.3	207	50.0	83

TABLE X

PER ACRE APPLICATION OF FERTILISERS ON DIFFERENT CROPS BY OWNER-CUM-TENANTS IN HIS OWN AND SHARE-CROPPED LAND

Crops	Owned Land	Share-cropped Land	% Dfference (rented land relative to owned land)
HYV *Boro*	247	195	—21.1
Local *Aus*	78	90	15.3
Local T. *Aman*	94	84	—11.6

The above findings may imply that the share-cropping system does not provide disincentives to intensive application of fertilisers. A direct test of whether share tenancy has negative effects can be made more specifically by comparing the performance on the share-cropped part with that of the owned part under the same holding. This pairing of observations, helps to control for other effects, such as the effects of differential resource endownents of cultivators, his landholding and educational status etc. The results of the exercise is presented in Table X. It can be noted that in HYV *boro* and local T. *aman,* the share-cropper (who cultivated these crops on both his owned and rented-in land) used less fertilisers on rented-in land than on his owned land. In the case of local *aus,* however, the opposite result was found. This aspect, however, needs a more thorough study.

[3]For a detailed treatment of this issue, see [11].

IV. SOME RELATED ASPECTS

Balanced Use of Fertilisers

In Bangladesh, fertilisers are usually applied in imbalanced proportions. Urea, whose impact is visible through growth of vegetation is usually applied in larger proportion than recommended. It may be argued that this may be the result of ignorance and lack of education among cultivators. As small farmers have less formal education than larger ones, it can be hypothesized that the size of the holding would have influence on fertiliser balance, i.e., large farmers will apply fertilisers in more balanced doses than will the small farmers. The findings of the survey in this regard are reported in Table XI. The main features that emerge from the table are the following :

(i) Contrary to expectation, many farmers use TSP in larger proportion than Urea. This was found in Chandra in the case of local *aus* ; and also among small farmers in the case of T. *aman*. In Banguri, in the case of HYV paddy and jute TSP was applied in larger proportion than recommended ;

(ii) Fertiliser application was not very much imbalanced as is usually thought to be. Only MP was used in considerably lower proportion than recommended. But the proportion of Urea and TSP was relatively balanced.

(iii) The hypothesis that the fertiliser balance is related to farm size can be rejected in the case of Chandra. However in Banguri the fertilizer use is less imbalanced in medium and large farms compared to the small farms.

TABLE XI

PROPORTION OF UREA, TSP AND MP USED IN DIFFERENT CROPS ACCORDING TO THE SIZE OF FARM

Crops	Recommended Proportion* Urea : TSP : MP	Proportion Applied By Small Farms	Medium Farms	Large Farms	All Farms
Chandra					
HYV Paddy	1 : .76 : .5	1 : 1 : .5	1 : 57 : .04	1 : .78 : .18	1 : .71 : .14
T. *Aman*	1 : 1 : .4	1 : 3 : .23	1 : .77 : 0	1 : .9 : .02	1 : .84 : ..02
Aus	1 : 1 : .4	1 : .8 : 0	1 : 1 .4 : 0	1 : 1 : 0	1 : 1 . 1 : 0
Banguri					
HYV Paddy	1 : .76 : .5	1 : .53 : .24	1 : .85 : .38	1 : .9 : .36	1 : .81 : .34
Jute	1 : .25 : .35	1 : .65 : .24	1 : .99 : .46	1 : .9 : .33	1 : .86 : .35
Mustard	1 : 2 . 5 : 1	1 : .77 : .29	1 : .86 : .32	1 : .9 : 36	1 : .87 : .33

*This information of BADC is based on reports from field officers. The recommended dose prescribed by the Bangladesh Soil Fertility and Soil Institute is different from BADC.

Fertiliser Prices Paid by Farmers

It is sometimes argued that small farmers have to pay higher prices for fertilisers than large farmers, because (i) the large farmers have better access to government officials and institutions supplying fertilisers, (ii) they also control fertiliser dealership and local markets and (iii) by virtue of their superior financial position they can buy fertilisers when prices are normal. If these arguments are valid then the differential price may act as a further constraint to expansion of fertiliser consumption on small holdings. So it would be useful to study whether small farmers do indeed pay higher prices for fertilisers in the market.

The prices paid by different groups of farmers for Urea, TSP and MP are reported in Table XII. The market prices were found higher than the government controlled prices for all three varieties of fertilisers in both villages. The price difference was higher in Chandra than in Banguri. So, bad transport and communication does not seem to be a reason behind such difference in price. Instead it may be due to large farmers' reported bulk purchase ahead of the season when prices remain normal ; and it may also be due to the more careful pricing policy of the dealers in Banguri. The price, difference was the highest for TSP. Compared to the government controlled price, cultivators in Chandra paid about 27 per cent more, and in Banguri 10 per cent more for this fertiliser. However, very little inter-farm variation in prices was found. Thus, small farmers did not face unfavourable prices in the market in comparison with other groups.

TABLE XII

FERTILISER PRICES PAID BY DIFFERENT SIZE GROUPS

(Tk. per maund)

Size Group	Urea	TSP	MP
Government Controlled Price	60.00	48.00	40.00
Chandra			
Small	67.20	57.88	40.72
Medium	68.52	65.00	52.04
Large	67.44	58.80	44.08
All Cultivators	68.00 (13.3)	60.80 (26.7)	45.20 (13.0)
Banguri			
Small	59.76	54.42	43.72
Medium	60.92	51.08	44.00
Large	60.64	53.68	43.00
All Cultivator	60.40 (0.7)	52.80 (10.0)	43.60 (9.0)

Note : Figures within brackets are the percentage difference in prices paid by farmers in comparison to the government controlled price.

The Source of Finance of Fertiliser Costs

Since fertiliser is a major cash input, the availability of finance may also influence the adoption and intensity of application of fertilisers. The cultivator's own surplus and his access to institutional credit are dependent on his landholding status which, in turn, may influence his decision to use fertiliser. To see whether this differential access to finance acts as a constraint to the utilisation of fertilisers, information was collected on the sources of financing the fertiliser cost. The findings are presented in Table XIII. The major portion of the cost was financed from cultivators' own surplus (69 per cent in Banguri and 56 per cent in Chandra). About one-fourth of the costs was met from credit from institutional sources. The non-institutional credit was used to finance about 20 per cent of the cost in Chandra and 8 per cent in Banguri. For large farmers most of the cost was borne either from their own surplus or institutional credit, while for small farmers a significant proportion of the cost was met through credit from non-institutional market (47% in Chandra and 23% in Banguri). It is wellknown that such credit is highly expensive.[4] This implies that the investment on fertilisers is more costly for small farmers compared to medium and large farmers.

TABLE XIII

RELATIVE IMPORTANCE OF DIFFERENT SOURCES FOR FINANCING FERTILISER COSTS

(Figures in % of total costs met from different sources)

Farm Size	Sources of Finance		
	Own Surplus	Institutional Credit	Non-institutional Credit
Chandra			
Small	42.8	10.5	46.7
Medium	50.3	28.2	21.5
Large	61.1	23.9	15.0
All Cultivators	56.2	24.1	19.7
Banguri			
Small	65.9	11.1	23.0
Medium	66.4	30.0	3.6
Large	73.6	26.4	nil
All Cultivators	68.6	23.7	7.7

[4]It is of course known from other evidence that some proportion of the non-institutional credit is given free of interest [13, p. 89 ; 5, p. 155]. But the rates of interest on the remaining non-institutional credit are so high that the average rate of interest may be higher than the rate for the institutional loans.

V. SUMMARY AND CONCLUSIONS

In this study an attempt is made to analyse the pattern of utilisation of fertilisers in various crops and among different groups of cultivators which may throw some light on (i) the nature of constraint to agricultural growth through diffusion of fertilisers, and (ii) the impact of the diffusion on the distribution of income. As the investigation is based on information collected from two villages, no generalisations can be made for Bangladesh from the findings which should be taken as tentative. The main observations are the following :

(i) A major factor explaining inter-farm and inter-regional variation in fertiliser use is the physical characteristics of landholdings. Fertiliser is used heavily in crops where the yield response is high (e.g., HYVs and mustard grown on irrigated land) but it is not used at all in crops which are grown on water-logged land (e. g., mixed *aus*/breadcast *aman*). The amount of fertiliser used per unit of land on a farm or in an area thus largely depends on the crop-mix, and the ecology may play a major role in influencing it.

(ii) Small farmers are found to be late adopters and they also use less fertilisers per acre of holding. But in comparable crops the small farmers use as much fertilisers as the large farmers inspite of the fact that investment on fertiliser is more expensive to the former who finances it relatively more with credit from non-institutional sources. The difference in fertiliser use per acre of holding among farms is largely explained by variations in crop-mix. The small farmers use less fertilisers per acre of holding compared with medium and large farmers mainly because they devote a smaller proportion of the holding to high-yielding varieties.

(iii) The tenurial status of a farm does not seem to have a negative inpact on fertiliser use except in the case of large holdings. The small and medium tenants use more fertilisers compared to owner-cultivators. Indeed, the tenants use larger amount on the rented part compared to the owned part of their holding becanse a larger proportion of the rented holding is devoted to growing high-yielding varieties which are heavy consumers of fertilsers. The reason why the tenant uses more fertilisers in spite of the disincentive effect of share-cropping system may lie in the subsistence pressure which urges a small farmer to maximise family incomes rather than profits.

The larger farmers are no doubt getting the lion's share of the fertiliser subsidy but this is due to the inequality in the distribution of land, better financial position of the surplus farmers, and their access to financial institutions. The findings indicate that the small size of a farm or the share-cropping system may not be a constraint to agricultural growth through intensive use of fertilisers, provided credit at reasonable terms is extended to the small farmers and tenants.

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Appendix

In order to test the hypothesis that small farmers use less fertilisers compared with large farmers, the sample households were divided into two groups and a 't' test was performed on the difference of the arithmetic mean of the amount of fertilisers used per acre of land for the two groups. The null hypothesis is that the amount of fertiliser used per acre is the same for the two groups of farms. The statistical significance of the difference in fertiliser use was estimated by using Fisher's Two Sample Test for the equality of means. Fisher's test is based on the assumption of equal variance of the variable in the groups of samples. When this assumption was found to be inappropriate, (an 'F' test was performed to know whether variance of the two groups were insignificantly different) 't' values were estimated from seperate variances rather than from pooled variance as under Fisher's test.

The arithmetic mean was calculated only for lands whe te fertiliser was used, and the mean was unweighted of the amount of land cultivated by the farmer. So the mean level of fertiliser use reported here may differ somewhat from figures for similar groups presented in the text. The results of the test are reported in Table A. 1. It can be noted that only in the case of jute and mustard in Banguri, small farmers used less fertilisers than large farmers but the difference is not statistically significant. In all other cases in fact, small farmers used more fertilisers, but the differences in these cases also are statistically insignificant.

TABLE A. 1

TEST OF SIGNIFICANCE OF THE DIFFERENCE IN FERTILISER USE BETWEEN SMALL AND LARGE HOLDERS ON OWNED LAND

Village/Crop	Arithmetic Mean of Fertiliser Used per Acre		% Difference (Group 1 Relative to Group II	Eastimated 't'
	Group I	Group II		
Chandra				
HYV Paddy	239 (7)	216 (18)	10.6	0.66
Local *Aus*	99 (15)	88 (17)	12.5	0.85
Local T. *Aman*	92	84	9.5	0.59
Banguri				
HYV Paddy	427	421	1.4	.09
Jute	150	155	-3.2	-0.19
Mustard	247	265	-6.8	-0.41

Note : Definition of Groups :
For Chandra : Group I : Upto 3.5 acres
Group II: More than 3.5 acres
For Banguri : Group I : Upto 2.5 acres
Group II: More than 2.5 acres

TABLE A.2

CROP MIX IN DIFFERENT SIZE OF FARMS AND TENURE

(Figures in % of total cropped land under the major crops)

Area/Size Group	% Area Under the Crop				
	HYV	Local *Aus*+	Local T. *Aman*	Jute	Mustard
Chandra					
Owned Holding :					
Small	8.2	38.1	42.8	10.7	*
Medium	14.1	38.2	41.1	6.5	*
Large	14.8	28.7	49.2	7.3	*
All Cultivators	13.2 (29.62)	34.2 (66.47)	44.8 (102.09)	7.7 (15.0)	* *
Rented Holding :					*
Small	28.3	29.3	42.4	*	*
Medium	26.5	26.3	47.3	*	*
Large	4.1	20.4	75.5	*	*
All Cultivators	21.9	25.9	52.2	*	*
Banguri					
Small	8.6	50.2	nil	25.3	15.9
Medium	15.5	37.4	nil	29.7	17.3
Large	7.7	39.4	nil	30.3	22.5
All Cultivators	11.0 (24.39)	41.8 (55.05)	nil	28.6 (37.89)	18.6

+In Banguri this is mainly a mixed crop with Broadcast *Aman.*

*Negligible area.

TABLE A. 3

FERTILISER UTILISATION IN MAJOR CROPS BY SIZE OF HOLDING AND TENURE

(lbs per acre of fertilised land)

Crops/Size of Holding	Owner Cultivator	Owner-cum-Tenants	
		Owned Land	Shared in Land
HYV paddy :			
Small	206	253	212
Medium	206	220	278
Large	237	194	154
Local T. *Aman*			
Small	78	95	78
Medium	86	95	167
Large	45	88	82
Local *Aus* :			
Small	111	93	136
Medium	64	86	118
Large	87	109	*

Measurement of the Economically Active Population—An Alternative Approach*

by

BARKAT-E-KHUDA**

I. INTRODUCTION

The size of the labour force or the economically active population (EAP) of a country indicates the proportion of its population who are engaged in economically gainful activities. In other words, it gives us the number of "producers" in the economy. But often in rural agrarian societies, one comes across labour force figures which seem quite devoid of reality. The incredibly low female labour force participation rates reported in Bangladesh throughout the period 1901-74 is a case in point. According to the Bangladesh Census 1974, female labour force participation rate was 2.5 [5]. But, as we shall see, this figure does not reflect the real picture. We shall argue that apart from various other factors which affect labour force data, the reliability of labour force statistics is also influenced by the approach adopted for its measurement.

After a critical review of the various concepts and approaches adopted in the measurement of labour force in rural agrarian societies we shall present an alternative approach to the measurement of the EAP. Section II of the paper discusses the evolution of the concept of the economically active population and provides a critical evaluation of the approaches generally adopted for its measurement. Section III proposes the alteranative approach and illustrates the nature of difference made by this approach by using the results of a survey carried out by the present author in a Bangladeshi village.

II. APPROACHES TO THE MEASUREMENT OF THE ECONOMICALLY ACTIVE POPULATION

The economically active population (EAP) comprises all those persons who contribute to the supply of labour in the production process. This includes the em-

*This paper is based on the unpublished Ph.D. dissertation of the author [12].

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ployed as well as those who are unemployed but available for work [16]. Such a definition of the EAP, although simple, is beset with numerous problems, specially in the case of the less developed countries.

The evolution of the concept of the EAP is closely associated with the process from which the modern industrialized market economy has arisen. The developed countries possess an advanced level of technology, which makes it possible for a relatively smaller proportion of the population to provide most of the needs of the economy. Moreover certain structural changes brought about by the advancement of technology over the long-run viz. shift of population from agriculture to industry, shift of production from small-scale to large-scale, (i.e., from household to factory units), replacement of self-employment by wage-employment etc., make it easier to distinguish between economic and non-economic activity. Distinguishing the EAP from total population is a relatively simple task under these conditions. However, in the LDCs, particularly in the rural agricultural sector, the distinction between the EAP and the total population seems to be artificial. In such societies technology still remains at a low level and this requires the participation of virtually the entire population in the production of goods and services.[1] Already some studies exist which show that children around 5-7 years of age in these societies contribute to the production process [1 ; 2 ; 8 ; 11 ; 18].

Most of the methods used in the recent censuses and surveys in most Asian countries to identify the EAP are related to the two broad approaches : the "gainful worker approach" (GWA) and the "labour force approach" (LFA).

The GWA is based on the idea that each person has a more or less stable functional role as a breadwinner following a gainful occupation and that this role is independent of his activity at any given time [15]. The major purpose of this approach is the enumeration of occupations ; the analysis of labour force and employment are only of secondary importance [4].

The only advantage of this approach is that the resulting data are not influenced by any seasonal variation, since there is no reference period or if there is one it is

1The following statement highlights the point :

"In the industrialized countries where the great bulk of the population participates in the market economy and receives money wages or profit for labour, the distinction between economic and non-economic activity is fairly clear-cut. On the other hand, in many countries of Africa, Latin America and Asia the role of market economy is much less prominent. A distinction between household chores and economic activity in such a society is somewhat artificial and the result of attempting such a differentiation depends to a large extent on subjective judgement. In such cases, even when the theoretical definitions and procedural rules adopted are the same the possibilities for variations in their application are tremendous" [16].

too long, such as a year. In fact, the predominance of seasonality in agriculture makes it reasonable for some of the LDCs to favour the adoption of this approach.

However, under this approach part of the labour force which should have been included i.e., the "new workers", are normally excluded from the labour supply, since they had no "occupation" to report. On the other hand, those persons who are working little or no longer actively employed nor seeking work, such as "retired" persons, are included. Obviously, the inclusion of "old workers" and exclusion of "new workers" make for biased estimate of the size of the labour force.

The labour force approach (LFA) was developed in the U.S.A. during the depression period of the 1930's. Its main objective was to measure unemployment, an objective that had not been well achieved with the GWA [7]. The LFA attempted to remedy some of the deficiencies of the GWA by introducing two concepts, namely activity and specific time reference. However, the main weakness of the LFA is that the data are likely to be affected by temporary and seasonal conditions at the time when the census is taken. The choice of a specific reference period and the length of the reference period are important, since these are likely to affect the size of the labour force and the classification of persons therein.

Besides the specific weaknesses of GWA and LFA, both these measures generally suffer from the following limitations :

(a) When the enumeration is made, the definition concerning the employed persons of the labour force raises a number of limitations and practical problems. As regards persons serving in government and other well-established institutions, there is no such problem since the enumerators can readily identify them, for in most cases they are employed throughout the year. However, in rural agrarian societies the seasonal and part-time workers form the bulk of the labour force and cannot be identified easily.[2]

(b) Both these approaches assume the prevalence of the kind of formalized, institutional work situation which is generally found in the developed countries where there is a clear distinction between "work" and "non-work" activity ; where home and work places are typically separate; where the notion of a "job", that is employment by another, as the nexus of work, is firmly embedded. These assumptions fail to recognize the very informal social and economic basis of work in the LDCs

[2]Jaffe notes, "Often other work opportunities may not be available so that the individual, in theory, could be classified as inactively seeking work. On the other hand, he could be classified as not in the labour force since he was not working and was making no effort to seek work. Further, if he has a small plot of ground on which he can spend a few hours' work per week, he is classified as employed" [10].

where agriculture is practised on a family basis and the participating group is fluid and difficult to define. In particular, difficulties arise with respect to the unpaid family workers. They form a large part of the labour force in agriculture and household industry. Their work in family farm or business is usually combined with and is not easily distinguishable from such activities as household duties, child care, etc. It is very difficult to draw a distinction between women who prepare meals for farm labourers and do other odd jobs and those who prepare farm products for sale [16]. However, treating them as employed without consideration to the amount of work done would inflate the employment figure and may lead to an underestimation of labour time underutilized. An ILO resolution recommended that to be counted as employed and economically active, unpaid family workers must work at least one-third of 'normal hours' [9]. Some countries have effectively treated all female unpaid family workers as economically inactive, particularly in the rural areas of Latin American countries and in Moslem countries of the Middle East. But these are simply arbitrary responses to a problem to which the traditional approaches have no answer.

(c) The question of minimum age limit raises serious problem. As regards the eligible age group it is recommended that the minimum age limit should be set in accordance with the customs and traditions prevailing in the country [17].[3] However, even if there are accepted age limits, the transition of a young person from student to working status does not always take place in a clear-cut way. It is a gradual process. During a specified period of time (adopted as the reference period) an individual may have dual characteristics [16], that is, a person may be a student and participating in economic activities at the same time. There is no provision in the recommended definition to cover this group of people.[4]

(d) Both these measures rely on the concept of "looking for work" to collect information on unemployment. In the context of developed countries, the question relating to "looking for work" would appear to be straightforward, but among people in rural agrarian societies it cannot be expected to elicit accurate information. Social and religious institutions and attitudes such as the observance of "purdah" have a forceful effect in making some people indisposed to work at all, if work is not available in the household. Moreover, in order to get a correct answer to this question, it must be assumed that people recognise themselves to be unemployed when they are actually so. But this is often not the case in practice. In one of the rounds of the National Sample Survey in India it was observed that "many people living in the

[3]Although in the 1974 Census of Bangladesh labour force information was obtained for persons aged 5—9 years, no tabulation was made for this age-group.

[4]In fact, this is the reason why under the alternative approach, we collect data on all persons aged five years and above, irrespective of working status (i.e., whether employed full-time or student, etc.).

villages would not regard themselves as unemployed so long as they were able to remain living on the earnings of other members of the family or were taking part, even to a nominal extent, in the activities of the household, on the land, or in a family business" [6].

(e) Both these measures are based on a pre-conceived notion of what constitutes "work". In both these approaches "work" refers to directly productive or income-generating activities. But in the context of rural agrarian society such as Bangladesh, the concept of "work" should be broadened to include besides directly productive activities, other activities essential to the maintenance of the household. Manderson observed "The majority of persons involved in activities not considered work are women. Their activities are not able to be reckoned conventionally; yet they relate directly to national well-being : they include child bearing and rearing, housshold cooking, cleaning, laundering, gardening, sewing and domestic animal husbandry" [13]. Thus, "work" should be defined in a broader and realistic sense to include productive work for cash earning, productive work in self-employed enterprise and household maintenance activities.

III. AN ALTERNATIVE APPROACH

Dissatisfaction with the conventional approaches has given rise to new concepts and measurement procedures. One such approach is the so-called "labour utilization framework" suggested by Philip Hauser. This approach has been tried in a number of areas and although it has led to some improvement in the usability of data, a lot of shortcomings still persist [12 ; 14].

Keeping in view the reality of the situation facing rural Bangladesh and the weaknesses of GWA and LFA, the present author developed an alternative methodology for the measurement of the economically active population.[5]

This methodology is called the labour utilisation approach (LUA) under which the working age population is first divided into two groups "workers" and "non-workers". A person is defined as a "worker" if he/she had contributed to directly productive activities (DPA)[6] for wage or profit or without any remuneration on the farm or business operated by the household for at least seven hours during the

5This methodology was first tired in a Bangladesh village, Barkait, in 1976 and the results are contained in [12]. Some modifications have since been made to the methodology and this is being tried now in another Bangladesh village.

6Labour necessary for generating income and capital is referred to as "directly productive activity" (DPA), and labour necessary for the maintenance and upkeep of the household which does not generate income or lead to physical capital formation is called "household maintenance activity' (HMA).

reference period ; and those who spent either no time or less than seven hours is classified as "non-workers". The cut-off point is kept low to obtain information on as many persons as possible (specially women and children) who had contributed time to DPA during the reference period.

Data are collected at least twice—once during busy season and once during slack season (so as to be able to examine the effect of seasonality in labour force participation and labour utilisation). For each worker information is obtained on the number of hours contributed to DPA inside family farm or business and those expended outside during the reference period which is usually the week preceding the enquiry.

The workers are also asked whether they wanted more work during the reference period and if so whether more work was available. A question relating to "looking for work" is not asked. Such a question, as discussed earlier, does not make much sense in rural agrarian societies where there is hardly any organized labour market. Information is also obtained on the income of the workers and the number of hours spent during the reference period on household maintenance activities.

A distinguishing feature of this methodology is that some useful information is collected for the "non-workers" as well, who are normally left out in such enquiries.

For each "non-worker" information is collected as to whether he/she had worked during the preceding cropping season, since although a person might not have worked the required number of hours during the reference period, he/she might have worked much more during the preceding cropping season. Such a question would help to establish the work force status of the "non-working population". For each of those who had worked during the preceding cropping season, information is collected on the number of hours worked during planting and harvesting season and on whether they had worked inside the family farm or business, or outside, or both during these periods. Information is also obtained as to whether they are interested in work and if so, whether they would accept work, if work opportunities are available. Finally, the non-workers are requested to reveal their preference for different types of work and the income levels (in case they work for others) at which they are prepared to work.

Such detailed information on the categories of both 'workers' and 'non-workers' are essential ingredients of this methodology as labour force, under this approach, is defined to include all "workers" as well as those classified as "non-workers"

but (a) who worked during the preceding cropping season and (b) who would accept work if it were available.

The merit of this approach, is that besides providing better estimates of labour force participation, it also provides for a more realistic esimate of unemployment and underemployment. Also, by collecting data on household maintenance activities, it provides us with information relating to the contribution of women and children to the household economy, an information not available by using the standard census approaches.[7]

The kind of difference this approach can make to the estimates of economically active population can be appreciated from the results of a survey this author carried out in a Bangladesh village (Barkait) in 1976.[8] Prior to administering the questionnaire on labour utilisation, data were also collected on labour force using both the 'gainful worker approach' (GFA) and "labour force approach" (LFA). Results given by the three approaches are presented in Table I.

TABLE I

LABOUR FORCE PARTICIPATION RATES IN BARKAIT

Sex / Approach	Male	Female	Both Sexes
GFA	52.9	42.3	42.9
LFA	51.1	4.9	27.9
LUA (a)	54.7	44.8	49.8
LUA (b)	54.3	49.2	51.8

Two separate estimates are given on the basis of the labour utilisation approach. In estimate (a), those among the non-working section of the population who worked during the preceding cropping season are added to the working population, while in estimate (b) those among the 'non-workers' were added who had expressed their willingness to work, if work were available.

7Various subsidiary information of these types resulting from an empirical application of our methodology are contained in [12].

8The survey was based on a one-shot questionnaire administered in the '*Aus*' season and was concerned with directly productive activities only among persons aged ten years and above.

We find that male labour force participation rates are roughly the same, whatever approach is adopted. However, there is a marked difference in female labour force participation rate obtained on the basis of the LFA and those obtained using the other approaches. This, perhaps, points to the limited utility of applying LFA in the enumeration of female labour force in rural agrarian societies.

Age-group-specific comparison of labour force participation rates done elsewhere [12] shows that for boys and girls aged 10-14 years the rates obtained using the labour utilization approach are higher than those obtained using the GWA and the LFA. In all other age groups the difference is not pronounced among males. Among females, the rates obtained on the basis of the labour utilization approach are higher than those obtained using the GWA and the LFA for all age-groups, except those aged 65 years and above. The difference is due basically to the following reasons ; (a) the labour utilization approach places emphasis on the number of hours worked rather than on occupation. This therefore, includes such persons as students, and those who worked only casually, such as women engaged more or less in full-time household work. The contribution of some of these persons to the household economy in respect of labour input are overlooked under the GWA and the LFA ; and (b) the concept of "looking for work" under the GWA and the LFA yielded a low proportion of the population who were not working but available for work. Such a concept of "looking for work" is, as observed earlier, not quite meaningful in a rural agrarian society where the notion of a "job" i.e., employment by another, is not firmly embedded. On the other hand, the question asked in the labour utilisation approach to the 'non-working' section of the population aged ten years and above, namely, whether they had worked during the cropping season preceding enumeration and also whether they would accept work, if work were available, helps to establish more accurately the proportion of population in the working age groups who may be considered as "out of work" and "available for work" respectively. These two groups are considered part of the work force under the labour utilization approach and hence the labour force participation rates obtained through this approach tend to reflect more truly the real situation obtaining in rural agrarian societies.

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Attitude Towards Induced Abortion in Bangladesh

by

RAANA AHMAD*

I. INTRODUCTION

The control of fertility through induced abortion is the most widely used clandestine contraceptive method of fertility regulation in the modern world [5 ; 12 ; 17]. According to International Planned Parenthood Federation estimates, about 34 million pregnancies in the world were terminated by abortion in 1976 both by legal and illegal procedures, suggesting one abortion for every three live births [7].

In Bangladesh abortion is only permissible for saving the life of the expectant mother. In all other cases, abortion (self-induced[1] or otherwise) is a criminal offence punishable with imprisonment and fines.[2] However, in practice, this law is now as good as obsolete. In fact, the Government of Bangladesh has recognised the role of abortion in curbing the rapid population growth in Bangladesh.[3] It also seems to believe that attitude towards abortion in this country is at least not unfavourable.[4]

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[1]Hereafter, all references to "induced abortion" are termed "abortion".

[2]The law with respect to abortion clearly states, "whoever voluntarily causes a woman with child to miscarry, shall, if such miscarriage be not caused in good faith for the purpose of saving life of the woman, be punished...." "Whoever, with intent to cause the miscarriage of a woman with child, does any act which causes the death of such woman, shall be punished...." (Abortion Law of 1860).

[3]In its First Five Year Plan (1973-1978), the Government observed : "Legalization of abortion has been known as probably the best and the most effective method for control of population growth. It should be seriously considered how this (abortion) method can be adopted to control population growth in Bangladesh" [15].

[4]"There is no indication whatsoever of any organized public opinion against it. On the other hand various seminars, public groups, women's organizations and the Bangladesh Family Planning Association have recommended liberalization of the existing rather harsh laws on abortion" [13].

In this paper we shall try to ascertain whether this belief is corroborated by the available facts. This information is expected to shed some light on the possibility of using this method of population control in this country on a wide scale. Data and methodology of the exercise are explained in Section II. Section III presents the findings on the attitude towards abortion in Bangladesh and a summary of the findings is presented in Section IV.

II. DATA AND METHODOLOGY

The first and only national investigation to date, to gauge the level of tolerance for abortion and to measure its prevalence in Bangladesh, was undertaken as part of the Bangladesh Fertility Survey (BFS) [14].[5] This data offers a unique framework for discussion of current attitude towards and prevalence of abortion in Bangladesh, particularly in the absence of any national data on abortion.[6]

The BFS was conducted by the Ministry of Health and Population Control on a nationally representative sample of 6,513 ever-married women aged less than 50.

There was considerable input by WFS staff in the design of the abortion questions. The desirability of raising a sensitive topic without endangering the entire interview, the terminology to be used and possibility of underreporting the prevalence of abortion were some of the issues raised. Before finalization of the BFS questionnaire, a pre-test was conducted on 280 ever-married women ; 160 rural and 120 urban women. Following scrutiny and evaluation of pre-test data, a separate section on abortion was added at the end of the questionnaire.

III. ATTITUDE TOWARDS ABORTION

Criticism in using a survey as a method of enquiry of this kind arises primarily because of the hypothetical nature of the issue being raised : many women have not had an unwanted pregnancy. In addition, select interviewer characteristics such as young age, single status, higher educational level, urban residence etc. may create barriers in interviewer-respondent interaction thus

[5]The BFS is a participating survey of the World Fertility Survey (WFS), an international research programme in fertility, now being conducted in some 41 countries.

[6]Micro-studies on attitudes towards abortion include [2 ; 6 ; 16]. Some of the microstudies on the incidence of abortion are [3 ; 9 ; 10 ; 11].

inhibiting respondent's freedom of expression.[7] Nevertheless, we expect that an analysis of the findings of the BFS will give some preliminary information on the issue under consideration.

It may be seen from Table I that an overwhelming majority of Bangladeshi women (more than 88 per cent) approve of abortion if the woman had conceived as a result of rape and pre-marital sex.

TABLE I

PER CENT DISTRIBUTION OF RESPONDENTS' ATTITUDE TOWARDS ABORTION UNDER SPECIFIED CIRCUMSTANCES

Specified Circumstance	Approve	Disapprove	Total
Mother's Health	14	86	100
Mother's Life	53	47	100
Malformed Child	30	70	100
Economic Reasons	17	83	100
Pre-marital Conception	88	12	100
Rape	89	11	100
Regardless of Circumstance	6	94	100

In a society where sexual relations are virtually limited to marital unions, and where strong moral and social stigma is attached to pre and extramarital sex, it is not surprising that BFS respondents sanctioned abortion under the effect, not the cause. The BFS questionnaire, it appears, did not succeed in conveying to the respondents the distinction between rape and pre-marital conception ; the cacnepts were interpreted synonymously. Danger to mother's life (53%) is a more acceptable ground for abortion than danger of a malformed child (30%). Abortion on economic grounds are acceptable to only 17 per cent of women.

An index was constructed measuring approval of abortion under a number of differing circumstances. Zero represents complete disapproval of abortion under any of the six specified circumstances ; 6 indicates approval under all six circumstances and 7 represents unconditional approval i.e., approval of abortion irrespective of circumstances.

[7]Ahmad [1] found in transcripts of BFS tape recordings that aggressive remarks by respondents may partly be attributed to the elitist composition of the interviewers which unintentionally places a measure of social distance between respondent and interviewer.

While 8 per cent of the respondents express disapproval under every circumstance, 5 per cent approve under all six specified circumstances and 2 per cent express unconditional approval (Table II).

TABLE II

Index	0	1	2	3	4	5	6	7
Per Cent Approving	8.2	3.8	32.4	24.5	15.4	8.9	4.7	2.0

We shall now try to see what types of variables affect women's attitude towards abortion in Bangladesh.

Background Variables

Residence

Approval of abortion by current and childhood place of residence shows that urban women hold more liberal views on abortion than rural residents (Table III). Only in the eventuality of pre-marital conception and rape, are the rural women slightly more approving of abortion that their urban counterparts. These two circumstances were very "real" issues facing women during the 1971 War of Liberation. In a wartime situation, rape becomes an emergency, a national issue, uniting diverse opinions and thus removing the residence

TABLE III

PERCENTAGE OF RESPONDENTS APPROVING OF ABORTION UNDER SPECIFIED CIRCUMSTANCE BY TYPE OF PLACE OF RESIDENCE

Specified Circumstance	Type of Residence			
	Rural		Urban	
	Current	Childhood	Current	Childhood
Mother's Health	14	14	16	21
Mother's Life	52	60	56	65
Malformed Child	28	28	34	42
Economic Reasons	16	16	23	27
Pre-Marital Conception	88	88	85	87
Rape	89	89	86	88
Regardless of Circumstance	7	6	10	11

differential factor.[8] It also emerges that women who had spent the formative years of their lives in urban areas express more approval as compared to women who migrated to urban centres at a later stage in their lives.

Education and Religion

Educated couples were found to be more approving of abortion than the less educated ones (Table IV). When both husband and wife have attained secondary or higher education, twice as many respondents approve of abortion under six specified circumstances compared to the situation where both husband and wife have no schooling.

TABLE IV

PERCENTAGE OF RESPONDENTS APPROVING OF ABORTION BY WIFE'S AND HUSBAND'S LEVEL OF EDUCATION

Index	0	1	2	3	4	5	6	7
Wife's Education Level More Than Husband's								
W-P ; H-0	7	3	27	22	18	14	6	2
W-S ; H-0	4	0	45	29	14	4	4	0
W-S ; H-P	0	10	27	15	24	24	0	0
Wife and Husband Same Education Level								
W-0 ; H-0	9	4	34	26	14	7	4	2
W-P ; H-P	7	3	33	23	16	10	7	2
W-S ; H-S	4	3	21	22	19	17	9	5
Husband's Education Level More Than Wife's								
W-0 ; H-P	7	4	33	24	17	9	4	1
W-0 ; H-S	7	5	33	24	15	8	6	3
W-P : H-S	6	4	28	23	18	13	7	2

0—No Schooling ; P—Primary Schooling ; S—Secondary Schooling or More.

8According to the National Board of Bangladesh Women's Rehabilitation Centre in Dacca City, out of a total of 22,500 applicants for abortion by women raped during the War of Liberation, 15,030 were rural women and 7,470 were urban women [9]. Although Bangladesh's urban population constitutes only 9 per cent of the total population and therefore proportionately more raped urban women had an abortion, it is worth considering whether the availability and accessibility of urban located abortion clinics was not related to a larger number of urban applicants. Greater reliance on indigenous folk methods as abortifacients by rural women may also account for the lower proportion of rural applicants.

TABLE V

PERCENTAGE OF RESPONDENTS APPROVING OF ABORTION UNDER SPECIFIED CIRCUMSTANCE BY LITERACY AND RELIGION

Specified Circumstance	Literacy		Religion	
	Can Read	Cannot Read	Muslim	Others
Mother's Health	19	13	14	14
Mother's Life	61	50	52	53
Malformed Child	37	27	29	29
Economic	20	16	17	16
Pre-marital Conception	88	88	88	88
Rape	90	88	89	88
Regardless of Circumstance	8	6	6	6

There is further evidence that the wife's ability to read is positively related to her attitude towards abortion (Table V). There are essentially no differences in attitude towards abortion between Moslems and others, namely, Hindus, Buddhists and Christians (Table V).

Demographic and Contraceptive Variables

Using the index constructed to measure approval of abortion, its relationship to a number of demographic and contraceptive variables are presented in Tables VIa and VIb.

Age at First Marriage

Since 96 per cent of the ever-married women have been married by the age of 17, age at first marriage at this point in time cannot be considered an explanatory variable. The small number of younger women (age $\angle$ 30) who married after the age of 20 are found to express more liberal opinions on abortion than their older counterparts.

Number of Children ever Born

Women with parity 4 or more view abortion more favourably than those with lower parity. This opinion is more pronounced among women aged $\angle$ 30 who have had 4 or more births than among older women with same parity. While 6 per cent of younger women reject all circumstances as legitimate grounds for an abortion, the comparable figure for older women is

9 per cent. Conversely, the most conservative approval of abortion is expressed by the older women who have a parity of less than 4. Since they would like to have an average of 5 children, few of them are likely to approve of pregnancy termination. On the other hand, younger women who desire fewer children are more ready to endorse abortion once they have achieved their ideal parity.

TABLE VIa

INDEX OF APPROVAL OF ABORTION BY DEMOGRAPHIC AND CONTRACEPTIVE VARIABLES
(For Women with Current Age < 30)

Variables \ Index	0	1	2	3	4	5	6	7
Age at First Marriage								
<20	7.6	3.9	31.8	24.4	15.8	9.5	4.8	1.9
20+	8.5	4.2	17.1	18.5	17.1	15.7	15.7	2.8
No. of Children Ever Born								
<4	8.0	3.9	32.3	24.4	15.3	9.8	4.4	1.7
4+	6.3	2.9	31.7	30.0	17.6	8.6	6.1	1.8
No. of Living Children								
<4	7.8	3.8	32.6	24.8	15.7	9.2	4.7	1.6
4+	6.5	2.8	30.4	23.7	17.3	10.9	5.9	2.4
Wanted Status of Last Pregnancy								
Wanted	7.4	3.7	32.8	25.4	16.6	8.8	4.0	1.3
Not Wanted	6.6	3.9	32.5	21.3	15.0	22.0	7.1	2.6
Desire for Future Birth								
Wants More	8.4	4.1	33.4	25.8	14.2	8.5	4.0	1.2
Wants No More	6.5	3.2	31.8	22.0	17.8	10.7	5.6	2.0
Ever Use of Contraception								
Never Used	7.8	3.4	33.9	25.6	15.5	8.1	4.2	1.5
Used Inefficiently	5.8	5.8	17.4	20.7	21.5	18.2	7.4	3.3
Used Efficiently	5.3	4.4	20.6	16.8	17.9	20.9	10.9	3.2
Current Use of Contraception								
Not Using	8.1	3.3	33.8	24.0	16.0	8.4	4.9	1.3
Using Inefficiently	3.3	2.2	13.3	20.0	22.2	25.6	5.6	7.8
Using Efficiently	5.0	6.3	24.0	17.0	17.0	18.3	10.6	2.1

Note : Figures indicate percentage of respondents approving abortion under specified circumstances. For explanation of indices 0—7, refer to Table II.

TABLE VIb

INDEX OF APPROVAL OF ABORTION BY DEMOGRAPHIC AND CONTRACEPTIVE VARIABLES
(For Women with Current Age 30+)

Variables \ Index	0	1	2	3	4	5	6	7
Age at First Marriage								
<20	9.2	4.3	31.3	24.3	14.9	8.4	4.9	2.4
20+	19.2	3.8	30.7	25.0	5.7	11.5	1.9	1.9
No. of Children Ever Born								
<4	10.2	3.9	37.7	25.4	12.8	6.0	2.8	1.1
4+	9.0	4.1	32.0	24.2	14.8	8.4	4.7	2.7
No. of Living Children								
<4	10.6	4.0	34.7	26.3	14.3	6.1	2.8	1.2
4+	8.7	4.1	32.0	23.7	14.7	8.9	5.0	2.9
Wanted Status of Last Pregnancy								
Wanted	9.2	4.4	32.7	25.9	15.4	7.4	3.7	1.2
Not Wanted	8.7	3.9	32.8	23.3	13.8	8.9	5.0	3.6
Desire for Future Birth								
Wants More	12.0	1.5	35.7	29.1	12.8	5.4	2.3	0.7
Wants No More	8.3	4.0	31.3	22.7	15.2	9.8	5.3	3.0
Ever Use of Contraception								
Never Used	10.2	4.1	34.2	25.9	13.5	7.0	3.2	1.7
Used Inefficiently	4.4	4.4	26.7	10.8	23.2	12.5	14.2	3.6
Used Efficiently	3.6	3.9	25.0	18.5	18.5	14.2	8.8	7.4
Current Use of Contraception								
Not Using	10.0	3.7	32.6	25.0	14.4	8.1	3.9	2.0
Using Inefficiently	9.6	4.8	28.9	9.6	13.2	13.2	15.7	6.0
Using Efficiently	4.4	3.7	19.2	21.4	19.2	14.0	9.6	8.1

Note : For explanation, see Table VIa.

Number of Living Children

The relationship between number of living children and approval of abortion by age is similar to that found between parity and approval of abortion by age. All women with more than 4 living children are more willing to approve of abortion than women with less than 4 surviving children. However, younger women already with a large number of surviving children tend to hold most liberal opinions on abortion. Older women with few surviving children are more reticent in their attitudes. It would thus appear that the high level of child mortality in Bangladesh probably has a "sobering effect" on attitude towards abortion particularly among older women.[9]

Wanted Status of Last Pregnancy

Women who did not want their last pregnancy express greater approval of abortion than women who desired the last pregnancy, among both groups of women. However, older women who did not desire the last pregnancy are less likely to approve of abortion as a means of limiting any future birth. Seven per cent of younger women and nine per cent of older women who did not want their last pregnancy reject abortion under all circumstances.

Desire for Future Birth

Whether a woman wants a future birth or not may have a bearing on her approval of abortion. Data show that there is an expected relationship between wanting no more children and greater approval of abortion for both groups of women. However, younger women express more willingness to permit abortion for women who do not want more children than their older counterparts.

Ever-use of Contraception

Are contraceptors more likely to approve of abortion than non-contraceptors ? Does the type of contraception used have a bearing on attitudes towards abortion ? Bangladesh data show that women with the most liberal views on abortion are also contracepting and relying on efficient means of contraception.[10] Older women who have never adopted any form of contraception are less likely to approve of abortion under specified circumstances than younger non-contraceptors. Among ever-users of contraception, it is

[9]According to the BFS Summary [8], older women have lost an average of 2 children ; among women with 3 live births, nearly half have had at least 1 loss, among women with 5 live births the proportion rises to two-thirds and among those with 8 live births to nearly nine-tenths.

[10]Efficient methods include pill, IUD, condom, and male and female sterilization. Inefficient methods include withdrawal, rhythm and abstinence.

interesting to note that the older women endorse abortion more liberally than do the younger ones. Twice as many women aged 30+ approve of abortion irrespective of circumstances compared to their younger counterparts (3 and 7 per cent respectively). In this context, it is worth noting that according to the BFS Report, only 7 per cent of ever-married women aged 15-19 had ever used a method and for women aged 35-39, 20 per cent had ever used a method. At older ages (40+), the percentage having ever used a method declined rapidly. Since effective contraceptive practice in Bangladesh is still largely adopted for preventive rather than spacing purposes implying geater adoption by older rather than younger women [4], fertility regulation by pre- and post-conception means is endorsed by women who want no more children. However, although few young women have contracepted, in the event of high parity and child survivorship, younger women too endorse abortion and do so more readily than the older woman.

Current Use of Contraception

Wider support for abortion is expressed by currently married, fecund, nonpregnant women who are currently contracepting and this support is more pronounced among women aged 30+ than among the younger women.

SUMMARY

In exploring national receptivity to the Government's guidelines on liberalization of current abortion laws, the BFS found Bangladeshi women giving an average of three circumstances under which abortion is permissible. Eight per cent of respondents reject all six circumstances as justifiable grounds for abortion. Five per cent express approval of abortion under all six circumstances. Unconditional approval of abortion is expressed by a small minority of two per cent. Extreme approval or disapproval of abortion, contrary to public opinion, is minimal today in Bangladesh.

Survey of respondents' attitudes towards abortion under specific circumstances reveal that excluding rape and pre-marital conception, which are the more extreme circumstances where approval of abortion is virtually universal, any danger to the physical well-being of mother and child are prime considerations for allowing abortions. More than half the respondents approve in the event of risk to the mother's life. Almost a third of respondents approve if a full-term pregnancy could result in a malformed child. Economic pressure and injury to mother's health rank lowest as a legitimate circ umstance for an abortion.

In Bangladesh the interplay of various factors like low age at marriage, long years of child-bearing, high parity, high child mortality, low level of contraceptive use and high fertility has a favourable effect on the approval of abortion, particularly among women aged less than 30.

But unless the younger women put into practice their ideals by adopting efficient contraception as a means of birth-spacing to control their fertility, they will continue to rely on abortion as an intermittent method of post-conception fertility regulation in the absence or failure of contraception. The family planning programme should encourage young women, who constitute the bulk of child-bearing women, to adopt efficient contraception and also provide safe and accessible abortion facilities as a back-up service since the contraceptive failure rate is expected to be high in the early period.

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Rural Transport and Development in Bangladesh*

by

JOHN TARRANT**

I. INTRODUCTION

The state of rural transport in Bangladesh is atrocious. The reasons are partly economic and partly physical. The twin physical difficulties are high, but seasonal, rainfall and a very largely flat land, crisscrossed by countless rivers, channels, and distributaries as well as the three main rivers of the Padma, Meghna, and Jamuna, which unite in central southern Bangladesh. The flooding which seasonally affects virtually the whole country, some 30 per cent of it to a depth exceeding 4.5 metres, is partly the result of the flood regimes of the three main rivers, which reach their peak flow at different times so as to extend the flood danger where they join over several months, and partly the result of the failure of the seasonal rain to run off. The construction of all-weather roads requires the prior construction of embankments to a level above the expected flood height and the construction of countless culverts and bridges over streams. In most cases the rivers are too wide for economic bridging with the present flows of traffic. The lower Ganges plain has an almost total lack of road-building materials and to provide a durable road surface which will withstand the ravages of the monsoon rains and the overloaded trucks and buses, requires either the importation of stone from the hilly peripheries of the country, or the firing of bricks from local clay. These bricks are then crushed and mixed with bitumen to make a road pavement. Earth or 'kutcha' roads rapidly

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* The paper is based on material collected during a study of rural transport conditions in Bangladesh by the Transport Survey Section of the Planning Commission of the Government of Bangladesh with a team of advisors from the Overseas Development Group of the University of East Anglia, Norwich, UK. The author is grateful to all those who helped in the survey and the writing of the report of the study [14]. The opinions expressed in this paper are the author's own and do not reflect the views of the Government of Bangladesh or of the Overseas Dovelopment Group.

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become impassable in the wet season as their surface gets cut into by the wheels of bullock carts. The third difficulty presented by the terrain arises from its seasonal contrasts. In much of the country flooding is highly seasonal and in the dry season many of the creeks and canals become impassable to even the smallest country boats. However, in the wet season the only method for a farmer to move outside his village may be by boat. This is especially true on the hoar districts of Sylhet and Mymensingh where the flooding is exceptionally deep and the houses are left sticking above the water like islands [5]. For mobility to be possible all the year round in these circumstances investment in both land and water transport is needed. Even in the less deeply flooded areas, for example, in the esturine areas to the south of the country, walking may be made difficult as the thousands of small creeks are often bridged only by a single bamboo pole, passage across which is hazardous enough without a load of some sort to carry.

This paper will concentrate on questions of rural transport only. Rural is defined here as from farm to market and from the smallest of the local markets to larger ones, usually up to the level of the thana headquarters, or to the major commercial centre of the thana, from which access is often available to arterial networks, either road, river or rail.

II. RURAL TRANSPORT, GROWTH AND INCOME DISTRIBUTION

The conventional wisdom is that poor rural transport provides a constraint for rural development in general. One would expect this to be especially true in Bangladesh where rural transport is manifestly poor and where the economic resources to improve it are largely lacking or have alternative, more pressing, needs. If rural transport is difficult it has two main effects. It inhibits the movement of surplus commodities out of a producing area, and thereby reduces the incentives for farmers to adopt new high yielding technologies because of the difficulties and costs of shipping the increased surplus to market. It delays or prevents the diffusion of these same technologies as fertiliser, fuel, and extension workers are all prevented from easy and cheap circulation in rural areas. This paper will however, concentrate only the questions of movement to market.

It is possible to subdivide a consideration of the possible inadequacies of rural transport into factors of speed, damage to commodities and cost, all of which are obviously interrelated. Speed in itself is rarely a requirement except in the case of highly perishable commodities such as pineapples

and mangoes and also for the movement of tea and sugarcane for processing. Product damage may occur if transport bottlenecks are coupled with poor or non-existent storage facilities. This is especially true for commodities moving during the monsoon. Rural transport in Bangladesh is labour intensive and, at least in most areas for most of the year, there is no significant shortage of labour, with approximately 30 per cent of the population already landless labourers. Labour is cheap and therefore the transport cost per ton/kilometre may not be high provided that wastage can be limited. Actual costs vary considerably depending on the distance travelled, the mode, and other considerations. Headloading varies from 13 to 25 taka[1] per ton/kilometre, pedal rickshaws from 5 to 13 taka, bullock carts from 3.3 to 7.5 taka, and country boats about 3.3 taka after the first three kilometres.

The ease or difficulty of transport and the role of traders are closely connected. Even in areas where water transport is almost the only option as in the Barisal District in the south of the country, only 36 per cent of the farmers cultivating less than 1.6 hectares own country boats. In such circumstances the first level of marketing has to be very local. In addition, for reasons we shall discuss later, farmers sell a proportion of their crop almost immediately after harvest and the harvest itself may be drawn out over several weeks as planting dates vary depending on water depths and other factors. The small farmer and his family has little time during the harvest and no money to either market the produce himself or to pay some one else to do it for him. If he is able to market himself it will be locally within a distance of about 3 kilometres and the rest of the marketing will be undertaken by traders of various sorts. The average distance over which traders travelled to markets was 33 per cent longer than farmers selling direct. The effect of poor transport on incentives for farmers to increase production resolves into the effects of transport on traders and the extent to which they pass their costs on to producers and might be expected to pass on any savings brought about by improved transport to these producers.

On this issue there are two sets of conventional wisdom. The first and probably the most widely held, assumes that almost all traders and middlemen between producers and consumers are profiteers, colluding to exploit both ends to the benefit of the middle, themselves. This feeling motivated the government takeover of the Indian wheat trade in 1973 and is a popularly held view in developed economies also. If such circumstances do indeed hold

then we might expect the benefits of rural transport improvement to be retained by the traders, not passed on to higher prices paid to the producers or lower prices to consumers.

The alternative view is that competition between traders leads to a not unreasonable price gradient between consumer and producer with traders taking a small profit given the difficulties of transport. Some evidence from other developing countries suggests that entry into trade is more or less free and that therefore, competition between traders is high [6; 7; 9 ; 10]. Traders are not sufficiently organised to act as a cartel against the interests of farmers and state takeover of this private trade is, at best, not expected to be any more efficient and, at worst, could cause almost complete breakdown in trade, as indeed happened in the case of the Indian wheat trade following government takeover. If this latter view is correct then investment in rural transport improvement will yield benefits to farmers in higher prices, and large and small farmers, with or without direct access to markets, will benefit and the income distribution in rural areas will remain unaffected, all groups being somewhat better off. The remainder of this paper will examine this utopian situation more closely.

Firstly, what exactly is the need for rural transport improvement ? At present in Bangladesh as a whole about 15 per cent of the total foodgrain production reaches the major urban markets [2], a little more than that goes through the government ration shop system which remain supplied largely by imports [20]. Generally agricultural investment remains low and the cropping ratio averages about 1.4 for the country. There is plenty of potential for increased production. Timmer [17] shows that the response to nitrogen fertilizer is very high and also irrigation possibilities remain largely undeveloped or underdeveloped. If this potential for increased production of foodgrains can be realised, it will greatly increase the amount which is commercially marketed, even allowing for the fact that some 40 per cent of the rural population of Bangladesh are below adequate nutrition levels [4]. However, the marketing situation is far from being this simple. Farmers, especially the small ones, sell paddy during and shortly after harvest and are then forced to purchase rice and paddy later in the season to meet the food needs of the family.[1]

[1]The reasons are twofold. Few farmers have on farm storage facilities other than those found within the household itself. Although this capacity may be fairly large it will rarely hold all the production either as rice or as paddy. Further, and probably of greater overall importance to small farmers, producers have to soll immediately after harvest to repay debts, often incurred for the purchase of food, accumulated throughout the rest of the year. Indeed, the paddy itself may be taken in payment for such debts.

Table I indicates that although the volume of trade originating with an individual small farmer is much less than from a large farmer, the small farmer buys and sells paddy and rice. Because for this reverse

TABLE I

PURCHASE AND SALE OF PADDY AND RICE

(Kg/farmer)

	Operational Holding Size		
	Small (0-1.6 hectares)	Medium (1.7-4.0 hectares	Large (4.1 +hectares)
Paddy harvested (less 10% seed)	1,701	3,522	10,436
Paddy sold within two weeks of harvest	112	280	1,081
Paddy sold over rest of year	183	667	1,640
Total paddy sold	295	947	2,731
Paddy bought	212	231	19
Rice bought	153	56	75
Paddy equivalent bought*	442	317	130
Paddy equivalent bought and sold	737	1,264	2,861

Source : Based on a sample survey of 155 farmers in Nalchiti thana, Barisal District.
*Assumes a paddy to rice ratio of 3 : 2.

TABLE II

HOLDING SIZE IN BANGLADESH

Holding Size (hectares)	Households %	Households Cumulative %	Area %	Area Cumulative %
0	32.9	100.0	0	0
0.01 - 0.40	25.7	97.1	9.4	100.4
0.41 - 0.80	16.4	41.4	14.4	90.6
0.81 - 1.61	14.2	25.0	24.3	76.2
1.62 - 3.23	7.8	10.8	26.2	51.9
3.24 - 4.86	1.7	3.0	10.2	25.7
4.87	1.3	1.3	15.5	15.5
Total	**100.0**		**100.0**	

Sources : Bangladesh Country Review (World Conference on Agrarian Reform and Rural Development, Summary Paper) Ministry of Agriculture and Forests, 1978.

trading, and the fact that small farmers make up the bulk of the farming population (Table II), the net result is that the transport system is clogged with rice and paddy, the movement of which is necessary, regardless of whether or not the area is in overall surplus. Most of the commodi-

MARKET TRADE IN NALCHITI THANA, BARISAL DISTRICT

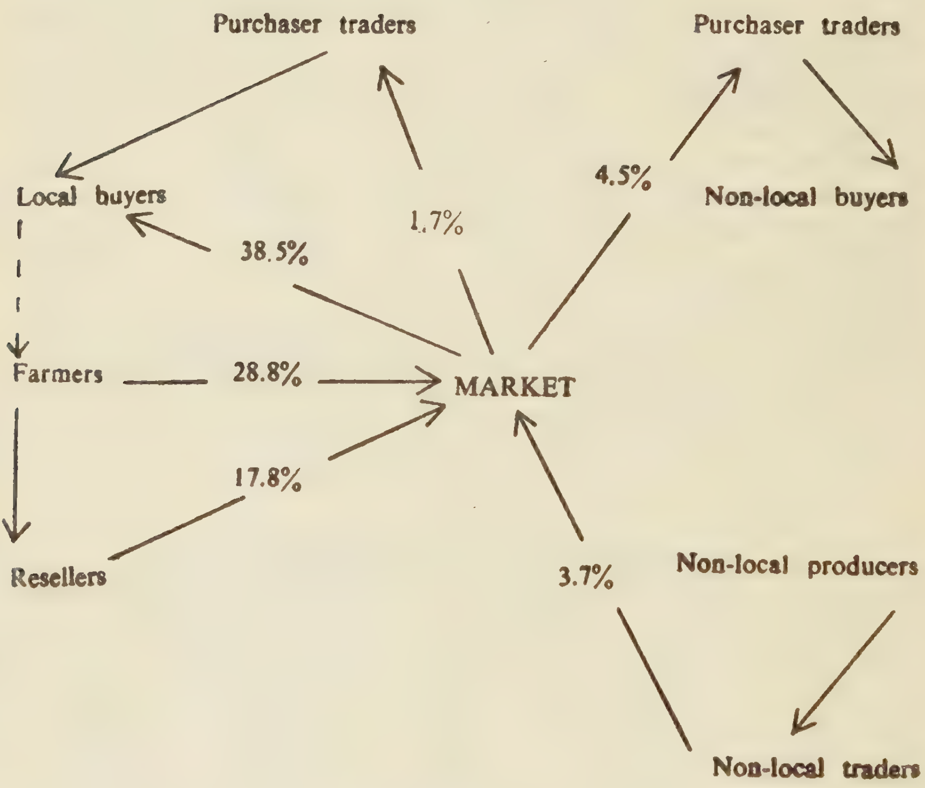

Figure 1

ties marketed are circulated in a fairly local area. A survey in Nalchiti thana in the Barisal District, found that as much as 92 per cent of the total marketing movements were contained within the area and only 8 per cent involved into and out of the area (Figure 1). Where a surplus exists a net outflow will be found, but there is reason to believe, even in an area like Sulla thana, Sylhet District, with a large foodgrain surplus, that large numbers of sales after harvest are for debt repayment and reverse flows of food take place in the off-season. Such a dominance of local circulation points to an alternative to rural transport investment. If storage and credit availability, especially for the small farmers, allowed the elimination of this reverse flow marketing, the transport channels would be free for the movement of the genuine surplus. It is important to assess these alternatives and to see that rural transport is not the only bottleneck to surplus shipment and not the only candidate for development funds.

Secondly, it is necessary to consider what might be the effects of improving rural transport. We must return to the debate about the competitiveness of traders and the possibilities of benefits accruing to the trade sector rather than to farmers. It is extremely difficult to obtain fair farm gate prices in many developing countries and Bangladesh is no exception. Much of the production not retained on the farm may not actually be sold but is delivered direct as share crop and/or debt repayments, which complicates the assessment of the effective price the farmer receives for his production. Price gradients from the local markets to the final consumer can be traced with relative ease [15] but the prices prevailing at the primary markets do not necessarily reflect the prices farmers actually receive.

There is evidence that the number of traders expands as soon as the opportunity for more trade makes itself felt and there may be intense competition for this new trade, although it is usually confined to the traditional trading families [1]. There are, however, several reasons why this need not be reflected in higher prices paid to the farmers. They all boil down to the fact that, although the market sector as a whole may be competitive, the relationship between an individual farmer and his trader may remain monopolistic. With rural markets at least every five miles over much of Bangladesh, a farmer appears to be presented with a choice. Most of the markets, especially the smaller ones, are periodic and perepatetic traders move from one to the other in cycles depending on the sequence of market days. The farmer will meet the same traders in all the available market places and competition is less than it appears. There is a further level of perepatetic trader, the one who goes to the farmers

buying and bulking goods at the farm gate. Even in the smallest market in the Nalchiti study 41 per cent of the people selling were resellers who had collected goods, mostly paddy, at the farm gate. Quantities sold in this way may be very small and necessitated by the need for cash for other goods for which the paddy may be bartered, or a lack of time to visit the market in person. There is unlikely to be much competition for these small quantities, especially as there are temporal constraints to the sale and the seller cannot afford to wait for a possibly better deal from the next trader. Even where the farmer can visit the market himself, either by walking, the case for the majority, or by country boat or bullock cart, the quantities for sale are often small. The average load of paddy for sale from all sources in the Nalchiti market surveys was 50 kilogrammes. Such small quantities restrict the number of buyers interested specifically to those who fulfil a bulking role. Much of the free entry to trading which does exist, is expended in the different levels of the trade between the producer and consumer and not in competition for the business of the individual farmer. Although Farruk [3] suggests that there is virtually no integration between the marketing intermediaries and the rice producers, evidence of the surveys on which this note is based indicates that a most important factor in restricting the competition for the produce of a single farmer is the debt relationship established between him and the trader. One farm family may have longstanding debt relationships with one trading family, the trader supplying cash or food in the off season in return for a share of the crop at harvest. The number of traders available at the various markets is irrelevant to this farmer. The evidence is far from conclusive, in fact there is virtually no hard evidence for debt relationships in Bangladesh. Farruk's study concentrates on markets and the debt relationships are more likely to be established at the farm gate, leaving the marketing of the paddy after repayment to the itinerant traders. The high proportion of non-farmers marketing, even in the smallest of rural markets, could not have been determined without detailed market surveys. It is put forward here as no more than a plausible hypothesis that, although the trade sector may be competitive and price gradients from the primary markets to the consumers may be reasonable, this does not mean that the price improvements concomitant with rural transport improvement will be passed to the producers. There seems at least a strong possibility that the benefits will be retained by the traders.

The benefits that accrue to farmers will not be uniform over all producers. Improvement in farm to market roads benefit only those farmers who are able to utilise these roads. The small farmer, without a vehicle

of any sort, will continue to walk down the road no matter how good the surface. His surplus is unlikely to be sufficient to pay for transport by others in bullock cart, rickshaw, or truck. The bigger farmers, of which virtually all in the Nalchiti study had their own boats, will benefit from investment in staightening and deepening river channels while the small farmer, without a boat, will continue to walk along the bank. A further serious consequence of transport improvement is also to be expected : the demise of the small local markets. The larger farmers with larger surpluses will be able to travel to more distant markets down the improved routes in order to take advantages of the higher prices in larger markets. But there is no reason to believe that the traders operating on the same routes will pass on the benefits to the smaller farmers. The volume of trade remaining in the smaller markets will be reduced, reducing the number of traders and the competition for the goods of the small farmers. Forty-five per cent of the families in Bangladesh farm less than 1.2 hectares (Table II) and it seems highly probable that transport improvements would be to their relative disadvantage.

The final set of effects concerns the 33 per cent of Bangladeshis who are landless labourers. After construction, all transport improvements are labour saving in the medium to long term [19]. A country boat to which an engine is added may create a demand for a limited amount of skilled work for maintenance but it displaces the labour of up to eight people previously employed in operating the boat in conditions of adverse wind and current. A rickshaw can carry four or five times that managed by a coolie headloading ; a path suitable for rickshaws helps to displace coolie labour. Of course, it can be argued that this is a necessary price to pay for investment in increased agricultural production and that the distributional aspects of this increased production and accumulated wealth will provide employment for those displaced providing services to agriculture and elsewhere in the economy [11]. Evidence remains scanty concerning such processes [16] and the alternative possibility of an increase in the number of unemployed or underemployed landless labourers remains unpleasantly real.

III. CONCLUSIONS

Very few examples of technological development in the developing countries can be shown to be genuinely neutral in their effects on income distribution. Roads are favoured "... because such investment does not generally bring into sharp focus some of the difficult issues which the selection and

implementation of schemes affecting agricultural land directly would almost inevitably raise" [18]. This paper argued that rural transport improvement was not neutral in its effects. The income distributional effects are present even if not in sharp focus. But, investment in road building is preferred for several other reasons. Roads are visible and the results are relatively easily audited. Some national governments like it because of the improved access it brings for the army, police, and civil administration. "Moreover road construction is such a contractor-oriented type of public work that, where decisions of this nature are dominated by considerations of political patronage and administrative corruption, it becomes the preferred investment even when it cannot be justified on any economic grounds at all [18]. Such was evident with the Bangladesh rural works projects of the 1960s. Rural transport development is certainly not the panacea for all the ills of rural development in Bangladesh.

What of the alternatives? Lele [9] has argued that there are seldom benefits to be had by passing the seasonal storage function back to the farmer. With seasonal rice price fluctuation sometimes in excess of 50 per cent and seemingly getting greater [20], it is hard to see that farm storage would not pay in Bangladesh. Certainly a recent OECD report [13] recommended that improved storage should be considered as an alternative to the construction of all-weather roads. Of course, storage is not neutral to scale anymore than roads are. The small farmer cannot store his production because of his debt repayment needs, and any schemes of village cooperative storage run the risk of being dominated by the larger farmers with large surpluses. Indeed rural road schemes may be easier to implement than the provision of rural credit and storage. The object of this paper is not to show that storage and credit are the answer to equitable rural development and that rural transport improvement is not, but to show that rural transport will not automatically be any more successful in providing for rural development while meeting the basic human needs of the rural poor in Bangladesh than other attempts at technological development in the countryside.

Rural roads are often built as a part of community organised self-help programmes *(swanirvar)*, in Bangladesh and there is no doubt that the value of such schemes in providing a sense of identity and purpose and employment in rural areas. Many such programmes involve road construction. It seems better to devote the energies engendered by such programmes to projects which are closer to being neutral to scale in their effects. Flood control is one possibility. The flooding effects rich and poor alike. The

large farmer has more to protect and therefore more to gain but it is less likely that the small farmer will be relatively worse off for flood control programmes. In the end, however, one is led to the inescapable conclusion that there must be a more equitable distribution of resources, especially land, in rural areas, before investment in the countryside can be shown to benefit all and not add to the problems of the poor [12].

Finally, the case for transport development to improve access into rural areas in much stronger than a case based on the need to ship agricultural commodities out. Shortage of skilled manpower of all sorts in Bangladesh means that medical, educational, family planning, and agricultural extension workers all need improved access into rural areas as a part of integrated rural development. One must beware of assuming, however, that just because transport and such development are related, improved transport will cause development [13]. The poor state of rural transport cannot continue to be used as a scapegoat for all the problems of developing the rural areas of Bangladesh.

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